



mobilewise

Mobile phone health risks: the case for action to protect children



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About MobileWise

MobileWise is a UK charity, raising awareness of mobile phone health issues, and promoting action to protect public health.

More information can be found at www.mobilewise.org

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Foreword

The substantial body of evidence highlighted in this report suggests that mobile phone use may be linked with a range of important health problems. These include, but are not limited to, brain tumours and the evidence has serious implications for public health.

Although further research is needed, it makes sense to err on the side of caution in the meantime. The long induction period for brain tumours and some of the other possible health effects means that it could take many years to fully understand the risks. We know from our experience with smoking and asbestos that waiting for certainty of harm is a dangerous policy. Even now we do not have a complete picture of those risks, despite many decades of scientific study.

We have an opportunity now to promote safety measures, mindful of the benefits of mobile phone technology but reflecting the potentially serious risks, particularly for children.

This report does much to elucidate the scientific evidence and policy issues. It is now incumbent on all of us engaged in the task of protecting public health to help ensure the public is provided with the information and guidance it needs to minimise its risks.

Kevin O'Neill FRCS (SN)
Consultant Neurosurgeon, Charing Cross Hospital, London

Executive Summary

A substantial body of evidence now points to potentially serious health risks from mobile phone use, especially for children. Steps can and should be taken urgently to protect the public, particularly the young, from health damage.

SUFFICIENT EVIDENCE

Our examination of the research shows that there are now more than 200 peer-reviewed published studies pointing to a link between prolonged mobile phone use and serious health damage. The evidence is both wide-ranging and compelling. The possible health risks identified include not only brain tumours but also damage to fertility, genes, the blood-brain barrier and melatonin production as well as other biological effects thought to have a role in cancer development.

The largest body of evidence concerns brain tumours. Almost every study of prolonged mobile phone use – roughly half-an-hour a day for 10 years – has found an increased risk of brain tumours. Several large-scale studies have found a doubling of the risk after only 10 years' use. This evidence contributed to the recent classification of mobile phone radiation as 'possibly carcinogenic' by the World Health Organization's scientific panel. And given the average latency period for brain tumours of about 30 years, these findings may well be the tip of the iceberg: the full effects may not show up in statistics for at least a generation.

This evidence, summarised on page 6, raises significant doubt about the safety of mobile phone use. This is especially so for children. Not only do their thinner skulls, greater tissue conductivity and smaller heads increase their radiation absorption when on a phone call, but their cumulative lifetime exposure to the radiation will also be much greater.

FAILURE TO ACT

Despite the accumulating research, the use of mobile phones continues to grow unabated. In the UK, 90% of secondary-school children and nearly 60% of 8-11's have a mobile phone.

Existing Government and industry guidance is inadequate and poorly communicated. The Department of Health's leaflet on children's risks is available only online and children, parents and schools are unaware of the vital guidance it contains. The few manufacturers' warnings that exist are almost impossible to follow and are buried in the small print of user manuals where hardly a customer sees them.

Consequently, public awareness of the risks remains minimal. Faced with contradictory media reports and an absence of clear, well-communicated guidance, most mobile users are left confused.

FALSE REASSURANCE

It has suited the mobile phone industry selectively to play up the evidence that argues against a causal link between phone use and health damage. Government agencies and departments similarly seek to allay public fears by emphasising the studies (mostly short-term) that appear to give phones the all-clear, thereby down-playing the uncertainty over long-term safety. This was the kind of wishful thinking that cost lives with tobacco and asbestos. The link to cancer was only proven some 25 years after the first studies were published.

SAFETY EDUCATION NEEDED

The fact that the evidence is not conclusive and that there are gaps in our understanding is not justification for inaction. Both the Government and phone companies could very easily do far more to alert the public, particularly children, to the emerging risks and safety measures. Given almost universal use of the technology, waiting for conclusive evidence before action is taken is irresponsible, especially when there are unrestrictive measures that can substantially cut the risks. Safety advice could be widely publicised at relatively little cost.

As the Council of Europe has recommended, the Government and phone companies need now to publicise their warnings and provide practical advice, especially for children. Schools, phone shops and the healthcare system should be enlisted into the effort. All this could be done with negligible expenditure, with the potential to save enormous costs down the line – in human as well as financial terms.

We need action now.

Introduction

When new substances and technologies hit the market, they often come with complex science, divergent scientific opinions and influential commercial interests. There are many examples of governments and regulatory bodies failing to act swiftly as a result, leading to irreversible damage to human health.

We have prepared this report because mobile phone users are repeatedly hearing of contradictory studies on the health effects of mobiles. We wanted to lay the science bare to help people understand the potential risks and to encourage policy-makers to take appropriate action.

Existing reviews have tended to look only at one type of health issue, particularly cancer. We wanted to reflect the breadth of evidence in arriving at policy recommendations.

This report is written for readers who are not specialists in this field but who wish to know two things: broadly what scientific evidence exists that supports concerns about the effect of mobile phone use on health, and how far this evidence justifies action to protect the public.

We describe the major areas of concern for human health and the evidence that supports each of these. In each case, we have summarised the research and pointed to the limitations or weaknesses of this evidence. Full details of the studies can be found in the Appendix.¹

We examine current government policy and corporate behaviour and make a series of recommendations to ensure that both the government and industry act swiftly to protect the public in light of the growing body of evidence now pointing to potential risks.

Throughout, we keep in mind that public health protection involves a difficult balancing act between the benefits of new technologies and their risks. The process is not simple and neither is the answer. However, waiting for a complete absence of doubt has led us in the past to miss opportunities to protect the public from damaging effects of new technologies. We offer this report in the hope it will help shape a modern and intelligent approach to these potentially serious risks.²

¹ Rather than cluttering the text with detailed references, we have referred at the bottom of each section (by first author and year of publication) to the studies supporting the statements made in the section. These studies and others are listed in the Appendix where, for ease of reference, we have included a short extract from the published report and a link to the journal abstract. In forming our conclusions, we have relied only on peer-reviewed studies published in a recognised scientific journal, but we have also included in the Appendix a short list of review papers discussing the issues raised.

² In this report we use the term “phone radiation” to refer to high frequency (radio frequency) electromagnetic fields, often abbreviated as RF EMF’s. Note that cordless phones (wireless phones with their own base station unit) also emit electromagnetic fields of similar frequencies.

Review of scientific evidence

Summary findings

CANCER AND OTHER TUMOURS

- Several studies among sizeable populations have found a doubling of the risk of some brain tumours after 10 or more years' mobile phone use for about half an hour a day.
- Studies indicate a possible link between mobile phone use and tumours of the parotid gland (a salivary gland in the region normally highly exposed to radiation during phone use).
- The World Health Organization's International Agency for Research on Cancer (IARC) has classified the radiation emitted by mobile phones as "possibly carcinogenic to humans" (Class 2B).

DAMAGE TO FERTILITY AND REPRODUCTION

- Laboratory and observational studies have found damage to sperm, impaired female fertility and damage to the unborn foetus from exposure to mobile phone radiation.

GENOTOXIC EFFECTS

- Laboratory studies from different research groups suggest that even after short periods of exposure to phone radiation, DNA strands can be broken and there are effects on gene expression. Phone radiation is capable of disturbing the DNA repair mechanism, and this can continue for several hours after the phone use.

DAMAGE TO OTHER BIOLOGICAL PROCESSES

- Laboratory studies suggest that phone radiation can damage the blood-brain barrier, causing a leakage of albumin into the brain.
- Studies have found significantly reduced levels of melatonin in humans after about half an hour's mobile phone use per day.
- Effects on heat shock proteins (similar to a stress response), oxidative stress, apoptosis (cell death) and damage to cell membranes have been identified in research. These are thought to have a role in cancer development.

CHILDREN AND YOUNG PEOPLE

- Children's brain tissue is more conductive, radiation penetration is greater relative to head size, and children will have a longer lifetime of exposure than adults: all increase their risk of harm.
- Laboratory studies have shown consistently that children's heads absorb up to double the energy that a large adult does when making a mobile phone call and that the energy can be concentrated in certain areas of the child's brain, resulting in up to 3 times the absorption in these areas.
- One study has found that the risk of brain cancer after prolonged mobile phone use is significantly greater in younger users than in adults.

1. Cancer and other tumours

The question of whether mobile phone use can cause cancer is one that is of great public health interest and of scientific debate. The main scientific problem is that cancers take many years to appear after the events that trigger their development. Here we review the available evidence.

Several studies among sizeable populations have found a doubling of the risk of some brain tumours after 10 or more years' mobile phone use for about half an hour a day³.

Studies indicate a possible link between mobile phone use and tumours of the parotid gland (a salivary gland in the region normally highly exposed to radiation during phone use).

The World Health Organization's International Agency for Research on Cancer (IARC) has classified the radiation emitted by mobile phones as "possibly carcinogenic to humans" (Class 2B).

There is, understandably, sparse evidence of raised cancer rates among short-term users of mobile phones, though some studies have suggested just such effects: participants who had used a mobile phone for more than one year had a 30% increased risk of one type of tumour (glioma) when compared with those who had not used a phone.

However, when it comes to longer-term use, a number of separate studies have found an increased risk of brain tumours.

Several of these have found that using a phone for more than 10 years approximately doubles the risk of being diagnosed with certain brain tumours (glioma and acoustic neuroma).

IARC classification - Class 2B: "possibly carcinogenic to humans"

The World Health Organization's International Agency for Research on Cancer (IARC) has classified the radiation emitted by mobile phones and other wireless devices as "possibly carcinogenic to humans". The largest study yet conducted, the Interphone study, found higher risks of brain cancer among people with substantial cumulative call times and an increased risk of a same-side brain tumour. The Interphone Study was an international multi-centre study carried out by IARC which reported in 2010. The widely reported main conclusion of the study was that there was no overall increase in brain tumours observed with use of mobile phones.

However, other findings of Interphone, subsequently highlighted by IARC (see Baan 2011) show an increased risk of some brain tumours after only 7 years' mobile use. Findings reported in Appendix 2 of the Interphone report – and therefore overlooked by media reports at the time – showed that substantial phone users (about 30 minutes a day for 10 years) were twice as likely to suffer from the most frequently malignant type of brain tumour, known as glioma.

IARC based its classification 'possible carcinogen' on the Interphone results, on a Swedish study that found that the risk increased with years of use and with total call time, and on a Japanese study which found evidence of an increased risk for acoustic neuroma associated with same side ("ipsilateral") mobile phone use. IARC also found some evidence of carcinogenicity in laboratory animals.

³ We refer to this elsewhere as "prolonged" use. Note that a lower average amount of use has been found in some studies to be associated with an increased risk, as little as a few minutes a day in some cases.

“Although both the Interphone study and the Swedish pooled analysis are susceptible to bias – due to recall error and selection for participation – the Working Group concluded that the findings could not be dismissed as reflecting bias alone and that a causal interpretation between mobile phone RF-EMF exposure and glioma is possible. A similar conclusion was drawn from these two studies for acoustic neuroma.”

Baan 2011 (IARC monograph working group report).

“We conclude that this meta-analysis gave a consistent pattern of an association between mobile phone use and ipsilateral glioma and acoustic neuroma using > or =10-years latency period.”

Hardell 2008

“The authors conclude that there is adequate epidemiologic evidence to suggest a link between prolonged cell phone usage and the development of an ipsilateral brain tumor.”

Khurana 2009

UNCERTAINTIES

There is controversy over the methods for gathering data in these studies. Estimates of mobile phone use invariably rely on the memory of individual users and, together with selection bias, this can distort findings. The Interphone researchers have stated that biases and errors limit the strength of their conclusions.

There is also a concern that these studies may be a poor guide to the effects of today's phone use. Average call times studied were low compared with today's exposure: some of the subjects in the Interphone study had used a phone for as little as half an hour a week and the old analogue phones didn't use a pulsing field (thought to exacerbate biological effects), though their power output was higher. Interphone did not adjust for cordless phone use, and as cordless phones operate using the same technology as mobiles, this may have resulted in a substantial under-estimate of risk.

On the other hand, tumour sufferers might be prone to over-estimating their phone use in retrospect.

Some authorities (the UK's Health Protection Agency and World Health Organization, for example) point to the studies that have not identified harmful effects as offering reassurance but these almost exclusively studied short-term use, in some cases as little as 3 years.

Only one large study that attempted to investigate the effects of long term phone use failed to find a statistically significant association (Frei 2011). Various problems have been raised by a number of scientists in the way the study was conducted and analysed, which could have severely distorted the findings. Misclassification problems were raised in the published paper itself. The earlier paper reporting on this study (Schuz 2006) was considered to be unreliable by IARC in its review of the evidence discussed above, saying that “In this study, reliance on subscription to a mobile phone provider, as a surrogate for mobile phone use, could have resulted in considerable misclassification in exposure assessment.” (Baan 2011).

Given that it takes on average about 30 years for brain tumours to develop, we know that any long-term effects have not been fully reflected in the findings, which have generally studied exposure periods of no more than 10 years. For this reason, the true effects may continue to be obscured for many years.

Another area of uncertainty is the fact that the biological mechanisms accounting for health outcomes like cancer have not yet been proven. While possible mechanisms have been identified (as discussed in part 3 of this section: Damage to Biological Processes), the evidence for these is limited, as yet. However, lack of detail over the causal mechanism is not a reason to ignore the evidence suggesting a causative link between phone use and brain cancer, particularly given that biological mechanisms connecting tobacco smoke and cancer are still not fully understood, 70 years on from the first published studies suggesting a link between them.

"The latest reviews of both the Hardell studies and the Interphone studies on brain cancers from mobile phones have noted their consistency when the analysis is rightly focused on the most likely at risk group i.e. those with longer than 10 years of exposure, where there is an approximately 1.5-2.0 fold increase in head cancers, particularly on the side of the head where the phone is most used."

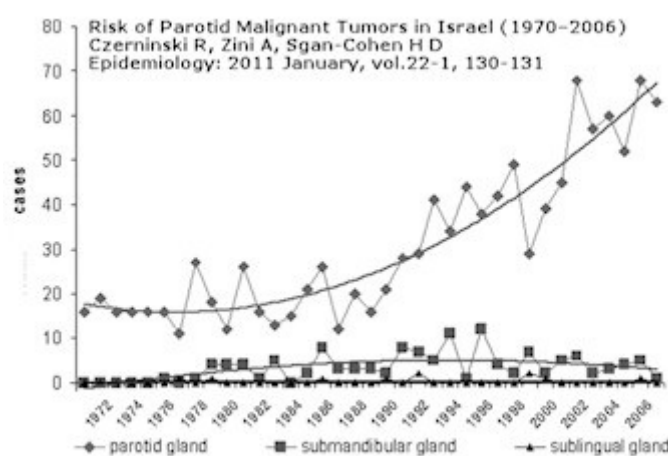
European Environment Agency 2011

TUMOUR INCIDENCE TRENDS

It has been suggested that if phone use caused cancer we would by now see this in cancer incidence data. But as others point out, we would not yet expect to see an increase in brain tumour rates in the overall population, because of the long-term nature of these risks and the multiple causes for brain tumours. Phones have only been used very widely for 10 or so years, and by children for much less than that. Given a latency lag thought to be at least 30 years (based on the average induction period for brain tumours caused by ionising radiation), a possible association with only some types of tumour and only in exposed parts of the brain, the absence of an obvious increase in overall brain tumour rates tells us little.

A rise in malignant brain tumours has been reported in Australia and a recent UK study (de Vocht 2011) has identified a small but potentially significant rise in temporal and frontal lobe tumours - the brain regions most highly exposed to mobile phone radiation. Data are not available identifying the trend in glioma and acoustic neuroma specifically, which might have been more revealing, given that these are the two types of tumour for which there is evidence of a link.

Additionally, a sharp rise in tumours of the parotid gland (a salivary gland) has been reported in Israel, where the majority of adults have been using mobiles for many years:



"It is of some concern that the trend in cancer of the parotid gland, which is adjacent to the head location of the mobile phone, in Israel is now rising, with the steepest rise after 2000, whilst other salivary gland tumours have remained stable; and the trend of brain cancers in Sweden appears to be rising. Both Israel and Sweden are amongst the heaviest and earliest users of mobile phones."

European Environment Agency 2011

(Baan 2011, Sato 2011, Dobes 2011, Duan 2011, Hardell 1999-2011, Cardis 2011a and 2011b, de Vocht 2011, Duan 2011, Czerninski 2011, Aydin 2011, Frei 2011, Interphone Group 2010, Yakymenko 2010, Khurana 2009, Kundi 2009, Morgan 2009, Myung 2009, Han 2009, Sadetzki 2005, 2008, Bondy 2008, Preston 2007, Schuz 2006, Lönn 2004, 2005)

CONCLUSIONS

Taken as a whole, this body of evidence raises a significant doubt over the safety of prolonged mobile phone use.

Multiple studies from a range of world-class institutions have reached similar conclusions, suggesting a doubling of risk of brain cancer in phone users after a decade's use or more, and a possible link with salivary gland tumours. Most studies that have looked at prolonged use have found an association. The findings are consistent enough to justify steps to properly inform the public of the potential risks and help them cut their exposures.

Problems in data collection, gaps in research and (as yet) unproven mechanisms of causation, mean that the research is not conclusive. However, the findings of the studies that have looked at prolonged use of mobiles are largely consistent and point to potentially serious harm.

That this is a basis for doubt over safety has been confirmed by the World Health Organization's International Agency for Research on Cancer (IARC) following a full review of the evidence in May 2011 by a 30-strong scientific panel. Most of the studies that have not found a link only investigated short term phone use; the absence of observable damage after exposure periods as short as only a few years comes as no surprise.

Even those studies that have looked at longer exposures may only hint at the long term risk. Given average cancer latency periods in excess of 30 years, we would not expect the full effect of any link between phone use and cancer to show up for some time yet in the research. Therefore, the doubling of the effect on tumour incidence that we are seeing in some studies after 10 years' phone use could plausibly turn out to be the tip of the iceberg.

There is no consensus amongst scientists and the subject often provokes heated debate. Many scientists take the view that the evidence doesn't point to a problem, and even the World Health Organization, whose own scientific panel has confirmed the possible link, has sought to allay fears by stating that "an increased risk of brain tumors is not established".

But there is now a substantial body of world-class scientists who emphasise the growing evidence of harm. While we cannot say definitively that "mobile phones cause cancer", we can confidently say that the evidence puts safety in serious doubt.

Given the major implications of this for public health, the issue requires urgent attention by public health agencies. In particular, it justifies efforts to help the public minimise their exposure to phone radiation, particularly to the head. Wishfully clinging to the fact that the link is not yet conclusively proven in order to support a policy of inaction is irresponsible.

"While more studies are needed to confirm or refute these results, indications of an increased risk in high- and long-term users from Interphone and other studies are of concern. There are now more than 4 billion people, including children, using mobile phones. Even a small risk at the individual level could eventually result in a considerable number of tumours and become an important public-health issue."

Cardis 2011a

2. Damage to fertility and reproduction

People commonly carry mobile phones in their front pockets, and text with the phone held near their laps. This makes the groin a potentially vulnerable area.

MALE FERTILITY

Laboratory and observational studies have found damage to sperm from mobile phone radiation.

Several studies have shown that exposure to mobile phone radiation degraded sperm with regard to their number, motility, viability, morphology and DNA. Some of these effects were shown to be linked to the duration and frequency of mobile phone use.

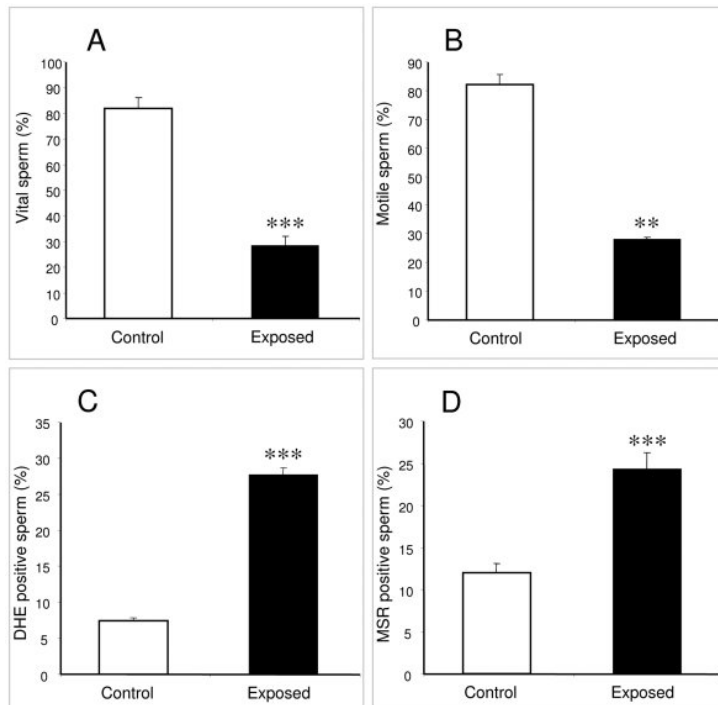
(Kesari 2010 & 2011, Gutschi 2011, Meo 2010, Otitologu 2010, Mailankot 2009, Agarwal 2008 & 2009; De Iuliis 2009; Eroglu 2006; Falzone 2011; Fejes 2005; Wdowiak 2007)

“These findings have clear implications for the safety of extensive mobile phone use by males of reproductive age, potentially affecting both their fertility and the health and wellbeing of their offspring.”

De Iuliis 2009

“Long-term exposure to mobile phone radiation leads to reduction in serum testosterone levels. Testosterone is a primary male gender hormone and any change in the normal levels may be devastating for reproductive and general health.”

Meo 2010



RF-EMR exposure decreases motility and vitality of human sperm while also inducing intracellular ROS. - De Iuliis 2009

FOETAL DAMAGE

Laboratory studies on animals have shown mobile phone radiation to be associated with impaired female fertility and damage to the unborn foetus.

Human foetuses subjected to mobile phone radiation had faster heart rates. Foetuses and newborns exposed to mobile phone radiation developed more behavioural and emotional problems.

Animal studies have found a significantly reduced number of ovarian follicles in female offspring when mothers were exposed to phone radiation during pregnancy. Other biological impacts on the foetus include genetic changes, altered brain development, cell death and auto-immune responses in blood serum. The latter led to more deaths in embryos and delayed development in babies.

(Guler 2010, Chavdoula 2010, Bas 2009, Fragopoulou 2009, Divan 2008, Rezk 2008, Gul 2009, Odaci 2008, Pyrpa-sopoulou 2004, Bas 2009, Grigoriev 2003).

CONCLUSIONS

This evidence indicates mobile phone use may affect fertility and foetal well-being. Though causation has not been conclusively established, these studies have important implications which have not been acknowledged in public policy: the absence of any mention of this problem in the advice given by government and phone companies is a serious omission.

Scientists working in this area recognise the need for more research to validate their results, identify the mechanisms whereby damage takes place and determine whether and how laboratory results are manifested in human health over time. But we do not need to know conclusively or precisely how and how much phone radiation damages fertility and the unborn foetus to take action to reduce the public's exposure to it, particularly to the groin area in men and to the abdomen of pregnant women.

3. Damage to biological processes

A major area of research relates to potentially damaging effects on underlying biological processes and structures.

This is for three reasons:

- concern for the functioning of those processes and structures in themselves
- the implications of any such damage for wider health outcomes (including future health problems for today's children)
- the need to find the mechanisms linking radiation to health problems.

Here we review the main areas of research.

GENOTOXIC EFFECTS

Genotoxicity describes a damaging action on a cell's genetic material affecting its integrity. This type of damage can lead to changes in cell function and to cancer.

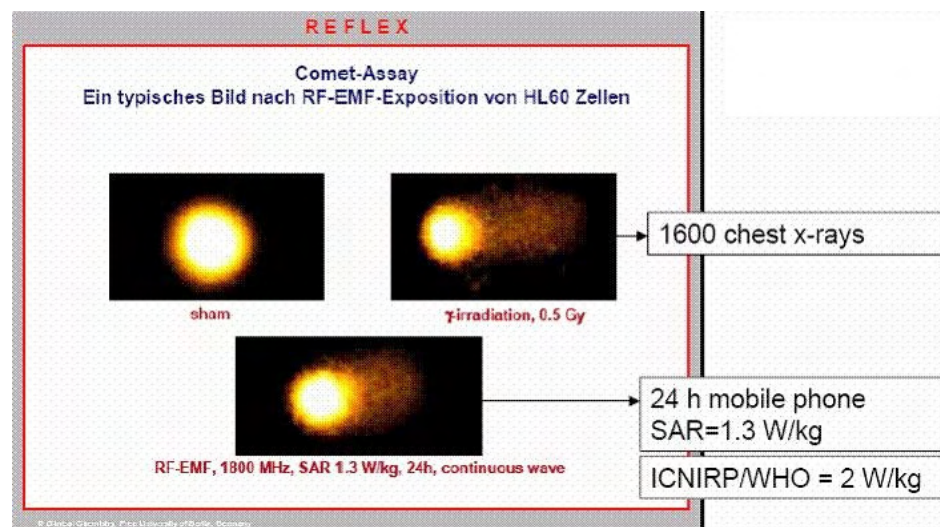
Laboratory studies from different research groups show that even after short periods of exposure to phone radiation, DNA strands can be broken and there are effects on gene expression.

Phone radiation is capable of disturbing the DNA repair mechanism, and this can continue for several hours after the phone is used.

(Karaca 2011, Belyaev 2005-2009, Ruediger 2009, Panagopoulos 2007, D'Ambrosio 2002, Ferreira 2006, Desai 2009, Czyz 2004, Del Vecchio 2009a, Franzellitti 2009, Karinen 2008, Schwartz 2008, Nylund 2006, REFLEX 2004, Karaca 1996, Lai 1995)

"Altogether there is ample evidence that RF-EMF can alter the genetic material of exposed cells in vivo and in vitro and in more than one way."

Ruediger 2009



Comparative DNA fragmentation images suggest electromagnetic radiation can produce DNA damage similar to ionising radiation. Reflex 2004

DAMAGE TO THE BLOOD-BRAIN BARRIER (BBB)

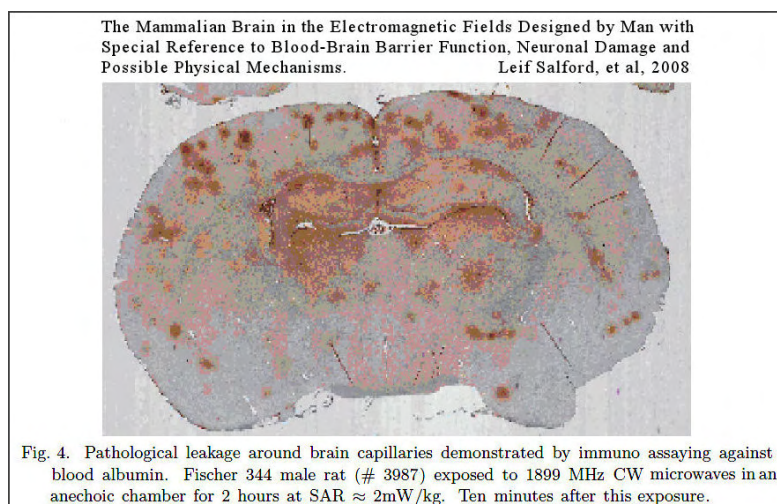
Laboratory studies suggest that phone radiation can damage the blood-brain barrier (BBB), causing leakage of albumin into the brain.

The BBB separates circulating blood from the brain and spinal cord fluid. Damage to the barrier allows an influx into the brain of normally excluded molecules, many of which are known to be harmful, such as bacteria, viruses and toxic substances. Damage can be associated with meningitis, increased swelling and even brain damage. Permeation of the blood-brain barrier is thought to increase the risk of brain cancers and neuro-degenerative illnesses (such as Alzheimer's disease).

(Franzellitti 2010, Seyhan 2011, Eberhardt JL 2008, Nittby 2008b, 2009, Leszczynski 2002, Persson 1997, Salford 1993, Schirmacher 2000)

"The mammalian brain is protected by the blood-brain barrier, which prevents harmful substances from reaching the brain tissue. There is evidence that exposure to electromagnetic fields at non thermal levels disrupts this barrier."

Nittby 2008



EFFECTS ON MELATONIN PRODUCTION AND CIRCADIAN RHYTHMS

Studies have found significantly reduced levels of melatonin in humans after about half an hour's mobile phone use per day.

Melatonin is a hormone that controls circadian (sleep/wake) rhythms. It is secreted at night by the pineal gland and produces many biological effects, one of which is to inhibit cancer. It also influences the onset of puberty, and reduced concentrations are associated with Alzheimer's disease.

"Prolonged use of cellular telephones may lead to reduced melatonin production, and elevated 60-Hz MF exposures may potentiate the effect."

Burch 2002

Some people seem more susceptible than others to this impact on their melatonin levels.

(Wood 2006, Arretz 2007, Huber 2000 and 2003, Burch 2002)

OTHER PROCESSES

Effects on heat shock proteins (similar to a stress response), oxidative stress, apoptosis (cell death) and damage to cell structures have been identified in research.

These are thought to have a role in cancer development.

(Blackiston 201, Esmekaya 2010, Panagopoulos 2007 and 2010a, Joubert 2008, Kesari 2010, Maskey 2010, Xu 2010, Guler 2010, Tomruk 2010, Agarwal 2009, Mailankot 2009, Meral 2007, Markova 2005, Sarimov 2004)

“Apoptotic cells were detected in the brain, eyes, kidneys, liver, lung, heart, and spleen.”

Guler 2010

CONCLUSIONS

Taken as a whole and together with evidence of health outcomes discussed elsewhere, this evidence paints a picture of varied negative impacts, many of which could have serious consequences for health.

It has been shown that mobile phone radiation can damage DNA, gene expression, production of melatonin, integrity of the blood-brain barrier and other processes thought to have a role in development of cancer and neuro-degenerative diseases. These findings support studies of long-term use that identify consequential damage. They urge both a precautionary approach to mobile phone use and more extensive and conclusive research.

There are inconsistencies in the research which may be explained by differential exposures, but further replication of results is needed before we can draw conclusions with absolute confidence. Additional uncertainties arise over the precise application of findings from laboratory and animal studies to real-life human exposures.

However, the possibility of immediate harmful health effects from mobile phone use raises doubts over the safety of mobile phone use which justify action to reduce exposure.

Additionally, given the question over the biological mechanism of action that has stalled acceptance of health damage in some quarters, this evidence may clarify the link between mobile phone use and diseases such as cancer, by providing mechanisms for harm.

4. Vulnerability of children

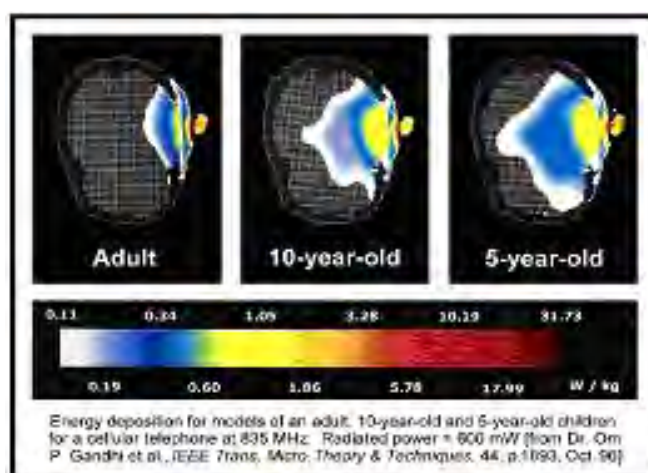
Children's brain tissue is more conductive, radiation penetration is greater relative to head size, and children will have a longer lifetime of exposure than adults.

Laboratory studies have shown consistently that children's heads absorb up to double the energy that a large adult does when making a mobile phone call and that the energy can be concentrated in certain areas of the child's brain, resulting in up to 3 times the absorption in these areas.

Concerns about the vulnerability of children to phone radiation have also been raised because of the potentially greater susceptibility of their developing nervous systems.

The key factors are:

- **Head size and cranial thickness.** Young skulls are smaller and thinner than those of adults, allowing higher radiation penetration. More of a mobile phone's radiation output penetrates the skull of a young person and, proportionately, a larger volume of their brain.
- **Incomplete myelination.** The protection of the central nervous system through the process of myelination – the formation of a protective sheath around each nerve cell – is incomplete until late into adolescence. This process is essential for the proper functioning of the nervous system.
- **Conductivity.** The higher water content of children's brains makes them more electrically conductive than those of adults. Absorbed RF radiation will be transmitted more efficiently and extensively as a result.



Radiation deposition for models of an adult, 10-year-old child and 5-year-old child show substantially greater penetration into the child's head: Gandhi 1996

"More radiation can go through since the child's ear is thinner, the telephone is closer to the head and this thinner ear doesn't absorb so much power. Therefore more is able to go past the ear into the head. All it takes is two millimetres difference."

Gandhi 1996

"It is shown that under similar conditions, the 1g-SAR calculated for children is higher than that for the adults. When using the 10-year-old child model, SAR values higher than 60% than those for adults are obtained."

De Salles 2006

One study has found that the risk of brain cancer after prolonged mobile phone use is significantly greater in younger users than in adults.

In a pooled analysis of case-control studies on malignant brain tumours and the use of mobile and cordless phones, the risk for astrocytoma (one type of brain tumour) was highest in the group with first use of a mobile or cordless phone before the age of 20. Among this group the odds ratio was 4.9 (i.e. they had approximately five times the risk). Another study of children who had only used a phone for a few years found the risk of brain tumours related to the time elapsed since the mobile phone subscription was started but not to the amount of use.

“The risk increased with latency time and cumulative use in hours and was highest in subjects with first use before the age of 20.”

Hardell 2011

Studies of the effect on brain tumour incidence of ionising radiation have found an association inversely related to the age at irradiation. In other words, the younger the child, the greater the risk. It is a reasonable assumption that the effects of phone radiation would similarly be significantly greater on children and this is confirmed by the limited evidence available.

(Gandhi 2011, Hardell 2011, Aydin 2011, Bakker 2010, Christ 2010, Hardell 2009, , Wiart 2008, Kuster 2009, De Salles 2006, Sadetzki 2005, Kheifets 2005, Martinez-Burdalo 2004, Wang 2003, Kang 2002, Gandhi 2002, Peyman 2001, Gandhi 1996)

CONCLUSIONS

Children appear to be more vulnerable to the effects of phone radiation than adults.

The large scale epidemiologic studies have not studied children, leading to major gaps in our understanding of the differences in the profile of risks for children and particularly for the developing brain.

However, experimental data as well as theoretical considerations point to a significantly increased risk for children. Evidence of children’s greater vulnerability to phone radiation suggests that the effects identified in other research are likely to be significantly greater for children.

Acknowledged differences in children’s anatomy mean they are likely to be more susceptible to any effects that occur. This conforms to our understanding of the greater health impact on children of other known toxins and is supported by the research to date.

This likely significantly greater risk for children has important implications that need urgent attention by policy makers, in view of the widespread use of mobiles by them. While some epidemiologic studies are under way in an attempt to clarify the risks for children, a greater focus on this area of research is needed.

Policy issues

1. Current public policy and corporate behaviour

This section provides an overview of the current policies of both public health bodies and mobile phone manufacturers. It explains why we believe these are inadequate.

UK PUBLIC POLICY AND GUIDANCE

In the UK, public guidance on mobile phone use is led by the Health Protection Agency (HPA), which monitors and reviews research internationally. It responds to reviews and guidelines issued by other organisations, particularly the Advisory Group on Non-Ionising Radiation (AGNIR), the Mobile Telecommunications and Health Research Programme (MTHR) and International Commission on Non-Ionizing Radiation Protection (ICNIRP).

The government professes to apply a precautionary approach which has been described by the European Environment Agency as:

“The Precautionary Principle provides justification for public policy actions in situations of scientific complexity, uncertainty and ignorance, where there may be a need to act in order to avoid, or reduce, potentially serious or irreversible threats to health or the environment, using an appropriate strength of scientific evidence, and taking into account the pros and cons of action and inaction.”

European Environment Agency 2011

Failure to take action to protect children

The Health Protection Agency’s most recent guidance reiterates the advice – first issued in 2000 - that children should limit their use of mobile phones. This advice continues to be made on the basis that scientific knowledge in this area is limited and that a question mark remains over long-term health risks:

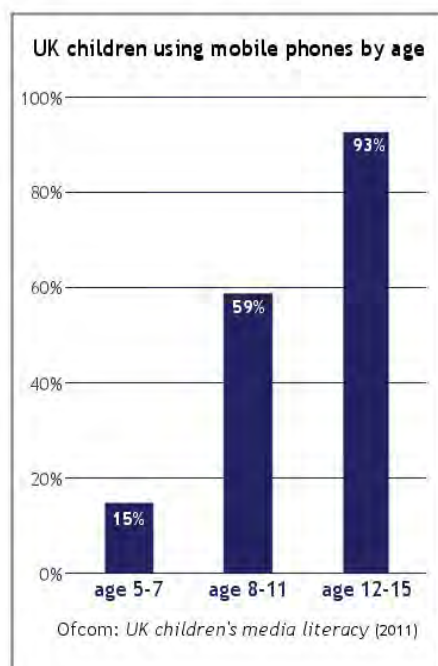
“Given the uncertainties in the science, some precaution is warranted particularly regarding the use of handsets held against the head. This is especially relevant to the use of handsets by children and the Agency recommends that excessive use by children should be discouraged.”

Health Protection Agency website October 2011

The Department of Health has issued a leaflet containing this advice. However, the advice is undermined by its context and low profile. First, it is included next to text that downplays the risks. Secondly, the leaflet itself has hardly seen the light of day – earlier versions were distributed to phone shops but few members of the public have seen them. Thirdly, the current version has only been issued electronically and, as yet, has not been promoted on government websites.

The Health Protection Agency’s own advice has not been given practical effect and a massive increase in the use of mobile phones by children has occurred in the intervening years. This failure to develop full guidance and communicate through all available media (e.g. government websites, the healthcare and education systems) and to ensure a joined-up approach to the risks (e.g. ensuring schools know about the advice and adopt policies consistent with it) is a failure of duty by government and public agencies. This is all the more apparent since governments in other jurisdictions have made efforts to communicate and publicise advice, such as in France, the Basque country and San Francisco.

Additionally, the HPA advice only reflects concerns about phone use next to the head and fails to reflect the evidence of other health damage, such as effects on fertility and the unborn foetus, which suggest that holding or carrying a phone near the groin and near the abdomen of pregnant women is inadvisable.



Failure to communicate uncertainty over safety of long-term mobile phone use

Some of the most serious potential hazards to health are beyond the reach of the science on which the Health Protection Agency's guidance is based. The agency itself acknowledges this in relation to the possible risks of cancer:

"As the widespread duration of exposure of humans to RF fields from mobile phones is shorter than the induction time of some cancers, further studies are required to identify whether considerably longer-term (well beyond ten years) human exposure to such phones might pose some cancer risk."

Health Protection Agency website as at October 2011 quoting the European Commission Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) in 2004

The focus of the current advice on evidence relating to short-term effects gives the misleading impression that the absence of strong evidence of short-term harm implies that prolonged long-term use is probably safe.

Yet there is evidence of both short-term damage to underlying biological processes, and of long-term harm. This alone justifies precautionary action.

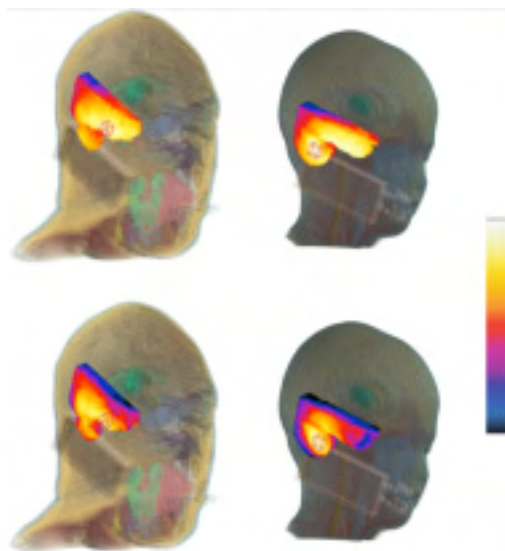
Failure to reflect biological damage outside 'thermal effects'

Current standards for the permitted strength of mobile phones are based on the extent to which the radiation they emit can heat the body. The measure used to determine this 'thermal effect' is the Specific Energy Absorption Rate (SAR), a measure of the energy absorbed by the head. Despite much evidence to the contrary, the Health Protection Agency currently approves an earlier (2000) report which concluded that *'heating remains the best basis for setting exposure limits.'* (The Independent Expert Group on Mobile Phones 2000).

The Specific Absorption Rate (SAR)

The SAR indicates the average energy absorption resulting from exposure to phone radiation. SAR ratings are assigned to each model of phone to ensure that the phone complies with guideline limits.

The SAR is measured using a model known as Standard Anthropomorphic Man (SAM), which is a homogenous adult male-sized head. Reliance on this way of measuring SAR does not allow for localised heating near the mobile phone handset and hotspots resulting from differential density and conductivity of tissue. Nor does it reflect the greater absorption by a child's smaller and more conductive head. Reliance on SAR leaves us with a regulatory model which does not reflect actual energy absorption and penetration patterns or account for young people's different anatomy.



Source: Environmental Health Trust

It has been found that the SAR certification process systematically underestimates exposure because the variability in density and capacity to absorb radiation of head tissues and organs can result in absorption significantly higher than the compliance guideline limit in some countries. This variability is higher in children leading to even greater over-exposure. (Ghandi 2011)

“The SAM-based cell phone certification process substantially under-estimates the SAR for 97% of the population, especially for children.”

Gandhi 2011

As well as doubts over the measurement method, many scientists have challenged the validity of the thermal model itself, as there is significant evidence of harmful effects of mobile phone radiation at levels below that which causes heating.

The body of evidence suggesting biological effects at non-thermal exposures (reviewed in section 3 of the earlier chapter “Review of Scientific Evidence”) undermines the view that biological processes are not affected by radiation exposures below ‘thermal levels’.

So far – and despite this evidence being brought to their attention – the Health Protection Agency and other advisory bodies have not changed their guidance. The Health Protection Agency’s website justifies this on the basis that “available work does not currently allow the mechanism of a non-thermal effect ... to be identified”.

In other words, they imply that, because we do not know exactly why this damage occurs, the only appropriate response is to defer acting on it.

There is a failure here to keep up with a fast-evolving body of research and to highlight clearly areas of uncertainty.

CORPORATE POLICY AND BEHAVIOUR

Despite the advice of the Health Protection Agency and other international organisations – as well as their own fine print warnings – mobile phone companies still fail to give that advice practical effect. Specifically:

Failure to provide and publicise effective warnings

The phone companies' own warnings, adoption of which could substantially reduce users' radiation exposure, are almost impossible to follow in practice:

"Use hands-free operation if it is available and keep the BlackBerry device at least 0.98 in. (25 mm) from your body (including the abdomen of pregnant women and the lower abdomen of teenagers) when the BlackBerry device is turned on and connected to the wireless network...Reduce the amount of time spent on calls."

BlackBerry Safety and Product Information booklet

The warnings also fail to explain why they are being issued, leaving the consumer more concerned but no better informed.

"Labelling and packaging is inadequate and guidance is buried too deeply in the small print of packaging booklets."

Tom Watson MP in House of Commons Adjournment Debate, 20 December 2011

Size and prominence of warnings in literature

Such advice as is provided is invariably buried deep in an obscure little booklet that almost no users would ever seek out or read.

For example, the warning for the iPhone 4 is contained in its "Important Product Information Guide" which is a tiny booklet (quarter of A5), separate from the instruction booklet and in a minuscule font (about 3-point). Contrast this with iPhone 4's warning about avoiding distraction when driving, which is placed prominently on the cover that wraps around the headphones.



The relative size of the iPhone statement in the tiny "Important Product Information Guide"

Failure to distribute government leaflets and in other ways to communicate government advice

The phone companies have shown no willingness to distribute government leaflets containing recommendations about limiting children's phone use, at the point of sale, on phone packaging or on their websites and advertising material. On the contrary, the government's leaflet is stored out of view in phone shops and phone companies' websites use language and emphasis implying that the debate over health is closed.

For example, the following statement was found on Vodafone's website:

"There has been extensive research into the effects of mobiles and masts on human health and the consensus of scientific opinion is that there is no proven adverse health effect if guidelines are complied with."

Vodafone website, October 2011

Failure to engage responsibly with users in order to arrive at other measures to help the public understand and minimise any risks.

There seems to have been no interest in the issue by the industry, nor wish to participate with public interest groups to help arrive at policies and measures to address this issue. Combined with abstruse fine print warnings, this gives the impression of an industry wishing to avoid legal liability without any real will to reduce their customers' potential risks.

CONCLUSIONS

The behaviour of industry and government is riddled with contradiction and a failure to grapple effectively with the problem.

The common thread is an apparent wish to warn - and hence avoid future liability or blame - without taking effective action.

The continual call for more research serves to distract attention from the need to take action now to protect the public.

This has led some to suggest that government and industry are more concerned with protecting profits and tax revenues than with applying the precautionary approach they espouse.

2. Implications and options

THE RANGE AND VARIETY OF RISK EVIDENCE

Health scares are not uncommon. But many of them arise out of one or two studies that prove to be methodologically flawed or are simply 'rogue' results.

This is not the case with mobile phone studies on health. The power of this evidence extends from:

- **Multiple types of study.** Laboratory and human case-control and cohort studies have all contributed to the growing body of evidence.
- **Diversity of research teams.** The results do not come from one research team with its own agenda; teams worldwide have contributed to the picture and continue to do so.
- **Range of outcomes identified.** The effects observed range from impaired behaviour and cell damage to infertility and cancer.
- **Some evidence of mechanisms of damage.** Because much of the research has focused on damage to biological processes, we are starting to build a picture of the mechanisms that link non-thermal levels of irradiation to diagnosable health impairment.
- **Implied acceptance by phone companies.** The warnings offered by mobile phone companies in their product packaging imply a recognition that these risks matter.

COMPARISON WITH THE EMERGENCE OF PAST HEALTH HAZARDS

History suggests that, if mobile phone use causes significant damage to human health, it will be many years before the evidence becomes so strong as to be irrefutable, even to the most sceptical observers and the industries involved.

As the European Environment Agency has pointed out (European Environment Agency 2002), more assertive adoption of the precautionary principle would have prevented large-scale human and environmental harm on numerous occasions in the last 100 years. In particular:

X-rays Injuries from exposure to X-rays were first reported in 1896. But the first rules of voluntary radiological protection (by the German Radiological Society) were not published for another seventeen years, and it took until 1961 for the UK to publish regulations covering the use of radioactive substances.

Asbestos Once regarded as a 'miracle' substance, asbestos was first identified as being harmful in 1898, with deaths recorded several years later. The EU finally banned all forms of asbestos 100 years later.

Smoking From the 1930s, scientific studies showed that cigarette smoking was related to lung cancer. However, it was about 25 years before a causative link was established conclusively and longer before steps were taken to change smoking habits. The tobacco industry, repeatedly called the emerging evidence into question, so the protective measures now in place in many countries took many decades to come about.

HOW MUCH EVIDENCE DO WE NEED?

Historically, the process of establishing scientific knowledge in public health has often involved a high level of proof, effectively proof beyond a reasonable doubt. For example, the link between tobacco and lung cancer was only considered "proven" by the UK Medical Research Council in 1957 after it was confirmed by 19 case-control studies from 7 different countries and by two very large prospective studies, in the USA (190,000 people) and UK (40,000 doctors). This high threshold of proof - effectively proof "beyond a reasonable doubt" - is higher than that used in most civil legal proceedings and for medical interventions where serious risks are to be averted.

Since then, the need for such a high level of proof has been challenged. It is now well-established that the level of proof of harm needed to justify action should be lower where the potential harm flowing from inaction is great. This was set out in a seminal paper by Sir Austin Bradford Hill, who, in 1951 with Professor Richard Doll, had produced strong evidence on smoking and the lung cancer risk in the UK:

"In passing from association to causation I believe in "real life" we shall have to consider what flows from that decision...Thus on relatively slight evidence we might decide to restrict the use of a drug for early-morning sickness in pregnant women. If we are wrong in deducing causation from association no great harm will be done"

Bradford Hill 1965

Brain tumours are an especially serious disease. At 20 years, the average amount of life lost from a brain tumour is higher than for any other cancer. Similarly, the other possible areas of damage outlined in this report carry very serious consequences for health. In these circumstances, the strength of evidence needed before action is justified is low, especially if the cost of action to reduce exposures is not high.

"Given the serious and largely irreversible nature of the brain tumour risk from mobile phones, it would be appropriate to take action on relatively weak evidence for an effect"

European Environment Agency 2011

RESPONSES BY OTHER GOVERNMENTS AND ADVISORY BODIES

The risks and the scientific research we have reviewed here are clearly not confined to the UK. Official action in other jurisdictions provides interesting comparisons with that of our own Government:

The Council of Europe has called for strict regulation of the use of mobile phones by school children on school premises and awareness-raising campaigns on the potentially harmful biological effects of electromagnetic fields targeting children, teenagers and young people of reproductive age— via legal authorities in its member countries.

The World Health Organization's International Agency for Research on Cancer (IARC) has classified mobile phone radiation as possibly carcinogenic to humans, within Class 2B.

The European Environment Agency has called on governments to adopt measures to reduce exposures to mobile phone radiation, particularly the exposures to children and young adults, as well as recommending stricter standards and warning labels.

USA The San Francisco city government recently brought in regulations requiring retailers to give all customers a government leaflet outlining safety steps. Similar proposals have been put forward in Maine and Pennsylvania.

France Mobile phones are banned from French primary schools, operators must offer handsets that allow only text messages, all phones must be supplied with a headset, sale to children under 6 is prohibited and advertising targeted at children is banned. The government has commenced a safety information programme through its National Institute for Prevention and Health Education.

Spain The Basque Parliament supported the Council of Europe's resolution and urged promotion of campaigns against excessive use of mobile phones among children.

Russia The Russian National Committee on Non-Ionizing Radiation Protection has recommended shortening calls, use of hands-free devices, warning statements on phones, education in schools, limits on use by children and a ban on advertising to children.

Canada The Canadian public health service has issued new cautionary guidelines on children's mobile phone use. They include practical advice for under-18s on how to reduce exposure to radiation by texting rather than calling, using hands-free devices and limiting the length of voice calls.

"Simple and low-cost measures, such as the use of text messages, hands-free kits and/ or the loud-speaker mode of the phone could substantially reduce exposure to the brain from mobile phones. Therefore, until definitive scientific answers are available, the adoption of such precautions, particularly among young people, is advisable."

Cardis 2011a

CONCLUSIONS

The scientific evidence that radiation from mobile phones causes harm to humans has been accumulating for years. It now points compellingly to a range of possible health effects, many of which are serious. But much of this research appears to have been overlooked by those who formulate public health policy.

“The Government take extremely seriously public concern over possible health risks from mobile phone technology, as they do all threats. There is a particular issue in that we are aware that health effects might not become apparent for 10, 20 or even 30 years.”

Anne Milton, Parliamentary Under-Secretary of State for Health in House of Commons Adjournment Debate, 20 December 2010

Government policy and corporate behaviour to date has been slow and ineffectual. That the evidence of lasting damage is not yet conclusive is no justification for inertia. There is enough evidence of biological damage to merit both strengthening of existing official safety guidance and much better communication of it.

Development of a full programme to inform the public and reduce their exposure to phone radiation is urgently required if the government is to finally follow long-standing Health Protection Agency recommendations to discourage excessive use of mobile phones by children and otherwise apply the precautionary principle espoused by government. Phone companies must recognise their responsibility to take a role in this.

Many deaths caused by agents such as tobacco and asbestos resulted from the view that official action should not be taken until serious damage could be definitively proven – even if that took decades. In effect, there was a presumption of safety in the absence of certainty of harm.

To allow the same presumption to be applied with mobile phones, already being used habitually by millions of children, would be both irresponsible and expensive. It is out of step with approaches to other public safety issues, especially those concerning children, where a “better safe than sorry” approach is considered best practice. Given the minimal cost of implementing safety measures and communicating advice, to defer such action is inexcusable.

We need Government and corporate action now.

“...taking effective precautionary action to avoid the plausible hazards of smoking in the late 1950s or early 1960s would have saved much harm, health treatment costs, and productivity losses from smoking. Waiting to prevent the then known risks of smoking in the 1990s, or later, incurred these very large costs to smokers, their families, and taxpayers.”

European Environment Agency 2011

3. Recommendations

The urgent imperative is for Government and the phone industry to take steps to help the public, especially children, cut their exposure to phone radiation. The Council of Europe has called on governments to take all reasonable measures to reduce exposure to electromagnetic fields, including phone radiation, and to put in place awareness-raising campaigns:

“The Assembly recommends that the member states of the Council of Europe...

...take all reasonable measures to reduce exposure to electromagnetic fields, especially to radio frequencies from mobile phones, and particularly the exposure to children and young people who seem to be most at risk from head tumours.

...put in place information and awareness-raising campaigns on the risks of potentially harmful long-term biological effects on the environment and on human health, especially targeting children, teenagers and young people of reproductive age.”

Resolution 1815 of the Parliamentary Assembly of the Council of Europe 27 May 2011

We have identified the following urgent priorities:

Information and education

1. The Department of Health’s leaflet should be re-drafted to provide clear advice and information enabling the public, particularly children, to reduce exposure to phone radiation. This should include steps to reduce harm from exposure to areas other than the head, particularly the groin area and the abdomen of pregnant women. Other communication tools should be developed, such as posters and adverts.
2. The leaflet, posters and adverts should be made available in print as well as electronic form. The leaflet should be given to all children in schools and publicised to parents, teachers and healthcare professionals. Posters and adverts should be on display in prominent places in schools, doctors’ surgeries, mobile phone shops, libraries and other public areas.
3. The recommendations contained in the leaflet should be publicised widely to children, parents and schools through all available low-cost means, such as in leaflets and talks given to children and parents by schools, and in material displayed in phone shops and doctors’ surgeries and on government, phone company and advisory websites.
4. Phone companies should actively engage in the information campaign, providing customers with clear practical advice in marketing literature, on websites and during conversation. Small-print warnings in phone instruction manuals should be replaced with clear statements in a prominent place on phone packaging.
5. Teachers, healthcare professionals and parenting advisers should be informed and educated about the safety measures so they can relay them to children.
6. Other initiatives to educate children should be developed to instruct them on safe use, for example in assemblies and relevant lessons (such as PHSE and science).

Facilitating exposure reduction

7. Schools should be encouraged to adopt policies to discourage phone use by children, for example restrictions on use within school buildings.
8. Corded phones should be provided where possible in schools and public places to reduce dependency on mobile phones.
9. Schools and parents should encourage children to use low-radiation headsets or speakerphone when using mobile phones for calls and not to carry their phones on their bodies on standby for long periods.
10. Parents should be discouraged from providing mobile phones to children before they are genuinely needed. Parents should be given advice by government and parenting advisers on minimum age of use by children. Phone retailers should be encouraged to sell exposure reduction devices, such as low-radiation headsets and belt clips.

Research

11. A wide programme of research should be commenced, covering the full range of potential effects, with particular focus on children. To ensure the funds allocated reflect the seriousness of the potential risks, the research should be funded by a levy on mobile phone purchase and use.

These measures may not go far enough but would be a good start. They have almost no downside and the costs of implementation would be comparatively small.

We owe it to the children growing up today to do these simple things to ensure they do not become the casualties of the future. We lose nothing by doing so. But if we fail to take these measures and the concerns turn out to be justified, we will have been complicit in a major public health failure. That is not a risk worth taking.

MobileWise
November 2011



The MobileWise Safe Mobile Code provides the public with simple practical measures that can significantly cut exposure



mobilewise

**Mobile phone health risks:
the case for action to protect children**

Appendix of scientific papers

1. INDIVIDUAL SCIENTIFIC PAPERS

These are some of the relevant published scientific studies we consulted in compiling this report. Please note:

- Only first authors are named, though most if not all these papers have multiple authors
- The web reference will take the reader to the abstract of the paper concerned
- The 'Author's conclusions' are verbatim extracts from the published article.

First Author	Date	Title	Citation	Web reference	Author's conclusions (verbatim extract)
Aalto S	2006	Mobile phone affects cerebral blood flow in humans	J Cereb Blood Flow Metab. 2006 Jul; 26(7):885-90	http://www.ncbi.nlm.nih.gov/pubmed/16495939	Our results provide the first evidence, suggesting that the EMF emitted by a commercial mobile phone affects rCBF in humans. These results are consistent with the postulation that EMF induces changes in neuronal activity
Abramson MJ	2009	Mobile telephone use is associated with changes in cognitive function in young adolescents	Bioelectromagnetics. 2009 Dec; 30(8):678-86	http://www.ncbi.nlm.nih.gov/pubmed/19644978	Overall, mobile phone use was associated with faster and less accurate responding to higher level cognitive tasks. These behaviours may have been learned through frequent use of a mobile phone
Agarwal A	2009	Effects of radiofrequency electromagnetic waves (RF-EMW) from cellular phones on human ejaculated semen: an in vitro pilot study	Fertil Steril. 2009 Oct; 92(4):1318-25	http://www.ncbi.nlm.nih.gov/pubmed/18804757	Radiofrequency electromagnetic waves emitted from cell phones may lead to oxidative stress in human semen. We speculate that keeping the cell phone in a trouser pocket in talk mode may negatively affect spermatozoa and impair male fertility.
Agarwal A	2008	Effect of cell phone usage on semen analysis in men attending infertility clinic	Fertil Steril. 2008 Jan; 89(1):124-8	http://www.ncbi.nlm.nih.gov/pubmed/17482179	Use of cell phones decrease the semen quality in men by decreasing the sperm count, motility, viability, and normal morphology. The decrease in sperm parameters was dependent on the duration of daily exposure to cell phones and independent of the initial semen quality
Aitken RJ	2005	Impact of radiofrequency electromagnetic radiation on DNA integrity in the male germline	Int J Androl 28(3): 171-9	www.ncbi.nlm.nih.gov/pubmed/15910543	This study suggests that while RFEMR does not have a dramatic impact on male germ cell development, a significant genotoxic effect on epididymal spermatozoa is evident and deserves further investigation
Al-Khlaiwi T	2004	Association of mobile phone radiation with fatigue, headache, dizziness, tension and sleep disturbance in Saudi population	Saudi Med J. 2004 Jun; 25(6):732-6	http://www.ncbi.nlm.nih.gov/pubmed/15195201	Based on the results of the present study, we conclude that the use of mobile phones is a risk factor for health hazards and suggest that long term or excessive use of mobile phones should be avoided by health promotion activities such as group discussions, public presentations and through electronic and print media sources
Aly AA	2008	Effects of 900-MHz radio frequencies on the chemotaxis of human neutrophils in vitro	IEEE Trans Biomed Eng. 2008 Feb; 55(2):795-7	http://www.ncbi.nlm.nih.gov/pubmed/18270019	The average time for the neutrophils to respond to the effect of RF radiation was about 2.5 min.
Andrzejak R	2008	The influence of the call with a mobile phone on heart rate variability parameters in healthy volunteers	Ind Health. 2008 Aug; 46(4):409-17	http://www.ncbi.nlm.nih.gov/pubmed/18716391	It was shown that the call with a mobile phone may change the autonomic balance in healthy subjects. Changes in heart rate variability during the call with a mobile phone could be affected by electromagnetic field but the influence of speaking cannot be excluded
Arnetz BB	2007	The Effects of 884 MHz GSM Wireless Communication Signals on Self-reported Symptom and Sleep (EEG)-An Experimental Provocation Study	PIERS Online Vol. 3 No. 7 2007 pp: 1148-1150	http://www.piers.org/piersonline/piers.php?volume=3&number=7&page=1148	The study indicates that during laboratory exposure to 884 MHz wireless signals, components of sleep, believed to be important for recovery from daily wear and tear, are adversely affected.
Auvinen A	2002	Brain tumors and salivary gland cancers among cellular telephone users	Epidemiology. 2002 May;13(3):356-9..	http://www.ncbi.nlm.nih.gov/pubmed/11964939	Cellular phone use was not associated with brain tumors or salivary gland cancers overall, but there was a weak association between gliomas and analog cellular phones
Aydin D	2011	Mobile Phone Use and Brain Tumors in Children and Adolescents: A Multicenter Case-Control Study	J Natl Cancer Inst 2011;103:1-13	http://www.oxfordjournals.org/our_journals/jnci/previews_releases/rooslidjr244.pdf	In a subset of study participants for whom operator recorded data were available, brain tumour risk was related to the time elapsed since the mobile phone subscription was started but not to amount of use. The absence of an exposure-response relationship either in terms of the amount of mobile phone use or by localization of the brain tumor argues against a causal association.
Baan R	2011	Carcinogenicity of radiofrequency electromagnetic fields	www.thelancet.com/oncology	http://www.download.thelancet.com/journals/lanonc/article/PIIS1470-2045(11)70147-4/fulltext	In view of the limited evidence in humans and in experimental animals, the Working Group classified RF-EMF as "possibly carcinogenic to humans" (Group 2B). This evaluation was supported by a large majority of Working Group members

Bakker JF	2010	Assessment of induced SAR in children exposed to electromagnetic plane waves between 10 MHz and 5.6 GHz.	Phys Med Biol. 2010 Jun 7;55(11):3115-30. Epub 2010 May 12	http://www.ncbi.nlm.nih.gov/pubmed/20463374	In this study, we found that the basic restriction on the SAR(wb) is occasionally exceeded for children, up to a maximum of 45% in small children.
Bas O	2009b	Chronic prenatal exposure to the 900 megahertz electromagnetic field induces pyramidal cell loss in the hippocampus of newborn rats.	Toxicol Ind Health. 2009 Jul;25(6):377-84	http://www.ncbi.nlm.nih.gov/pubmed/19671630	Therefore, although its exact mechanism is not clear, it is suggested that pyramidal cell loss in the cornu ammonis could be due to the 900 megahertz electromagnetic field exposure in the prenatal period
Bas O	2009a	900 MHz electromagnetic field exposure affects qualitative and quantitative features of hippocampal pyramidal cells in the adult female rat	Brain Res. 2009 Apr 10; 1265:178-85	http://www.ncbi.nlm.nih.gov/pubmed/19230827	These results may encourage researchers to evaluate the chronic effects of 900 MHz EMF on teenagers' brains
Beason R	2002	Responses of neurons to an amplitude modulated microwave stimulus	Neurosci Lett 2002 Nov 29; 333(3):175-8	http://www.ncbi.nlm.nih.gov/pubmed/12429376	Most (76%) of the responding cells increased their rates of firing by an average 3.5-fold. The other responding cells exhibited a decrease in their rates of spontaneous activity Such responses indicate potential effects on humans using hand-held cellular phones
Belyaev IY	2009	Microwaves from Mobile Phones Inhibit 53BP1 Focus Formation in Human Stem Cells Stronger than in Differentiated Cells: Possible Mechanistic Link to Cancer Risk	Environ Health Perspect. 2009 Oct 22. [Epub]	http://www.ncbi.nlm.nih.gov/pubmed/20064781	Microwaves from mobile phones inhibit 53bp1 focus formation in human stem cells stronger than in differentiated cells: possible mechanistic link to cancer risk
Belyaev IY	2009	Microwaves from UMTS/GSM mobile phones induce long-lasting inhibition of 53BP1/gamma-H2AX DNA repair foci in human lymphocytes	Bioelectromagnetics. 2009 Feb; 30(2):129-41	http://www.ncbi.nlm.nih.gov/pubmed/18839414	The non-parametric statistics used here did not indicate specificity of the differences revealed between the effects of GSM and UMTS MWs on cells from hypersensitive subjects and more data are needed to study the nature of these differences
Belyaev IY	2006	Exposure of rat brain to 915 MHz GSM microwaves induces changes in gene expression but not double stranded DNA breaks or effects on chromatin conformation	Bioelectromagnetics. 2006 May; 27(4):295-306	http://www.ncbi.nlm.nih.gov/pubmed/16511873	The data shows that GSM MWs at 915 MHz did not induce PFGE-detectable DNA double stranded breaks or changes in chromatin conformation, but affected expression of genes in rat brain cells.
Belyaev IY	2005	915 MHz microwaves and 50 Hz magnetic field affect chromatin conformation and 53BP1 foci in human lymphocytes from hypersensitive and healthy persons	Bioelectromagnetics. 2005 Apr; 26(3):173-84	http://www.ncbi.nlm.nih.gov/pubmed/15768430	In conclusion, 50 Hz magnetic field and 915 MHz microwaves under specified conditions of exposure induced comparable responses in lymphocytes from healthy and hypersensitive donors that were similar but not identical to stress response induced by heat shock
Blackiston	2011	Transmembrane potential of GlyCl-expressing instructor cells induces a neoplastic-like conversion of melanocytes via a serotonergic pathway	Disease models and mechanisms 4(1):67-85	http://www.ncbi.nlm.nih.gov/pubmed/20959630	These data reveal GlyCl as a molecular marker of a sparse and heretofore unknown cell population with the ability to specifically instruct neural crest derivatives, suggest transmembrane potential as a tractable signaling modality by which somatic cells can control stem cell behavior at considerable distance.
Blackman C	2009	Cell phone radiation: Evidence from ELF and RF studies supporting more inclusive risk identification and assessment	Pathophysiology. 2009 Aug; 16(2-3):205-16	http://www.ncbi.nlm.nih.gov/pubmed/19264460	Most national and international reviews of the research area since the 1986 report [National Council for Radiation Protection and Measurements, ref.] have not included scientists with expertise in NTE [non-thermal effects], or given appropriate attention to their requests to include NTE in the establishment of public-health-based radiation exposure standards.
Blank M	2009	Electromagnetic fields stress living cells	Pathophysiology. 2009 Aug; 16(2-3):71-8	http://www.ncbi.nlm.nih.gov/pubmed/19268550	It is clear that in order to protect living cells, EMF safety limits must be changed from the current thermal standard, based on energy, to one based on biological responses that occur long before the threshold for thermal changes.
Bondy ML	2008	Brain tumor epidemiology: consensus from the Brain Tumor Epidemiology Consortium	Cancer. 2008 Oct 1;113(7 Suppl):1953-68	http://www.ncbi.nlm.nih.gov/pubmed/18798534	[subject: latency]
Borbely AA	1999	Pulsed high-frequency electromagnetic field affects human sleep and sleep electroencephalogram	Neurosci Lett. 1999 Nov 19; 275(3):207-10	http://www.ncbi.nlm.nih.gov/pubmed/10580711	The results demonstrate that pulsed high-frequency EMF in the range of radiotelephones may promote sleep and modify the sleep EEG
Bormusov, E	2008	Non-Thermal Electromagnetic Radiation Damage to Lens Epithelium	Open Ophthalmol J. 2008; 2: 102–106	http://www.ncbi.nlm.nih.gov/pubmed/19517034	The effect of the electromagnetic radiation on the lens epithelium was remarkably different from those of conductive heat. The results of this investigation showed that electromagnetic fields from microwave radiation have a negative impact on the eye lens.
Burch JB	2002	Melatonin metabolite excretion among cellular telephone users	Int J Radiat Biol. 2002 Nov; 78(11):1029-36	http://www.ncbi.nlm.nih.gov/pubmed/12456290	Exposure-related reductions in 6-OHMS excretion were observed in Study 2, where daily cellular telephone use of >25 min was more prevalent. Prolonged use of cellular telephones may lead to reduced melatonin production, and elevated 60-Hz MF exposures may potentiate the effect
Burnet NG	2005	Years of life lost (YLL) from cancer is an important measure of population burden – and should be considered when allocating research funds	British Journal of Cancer (2005) 92, 241 – 245	http://www.ncbi.nlm.nih.gov/pubmed/15655548	Average years of life lost measures the burden to individual patients and may be helpful where individuals' needs are relevant, such as palliative care. As well as crude mortality, more subtle and comprehensive calculations of mortality statistics would be useful in debates on research funding and public health issues.

Cao Z	2000	Effects of electromagnetic radiation from handsets of cellular telephone on neurobehavioral function	Wei Sheng Yan Jiu. 2000 Mar 30; 29(2):102-3	http://www.ncbi.nlm.nih.gov/pubmed/12725088	The results suggested that the handset using could cause adverse health effects in neurobehavioral function
Cardis E	2011b	Risk of brain tumours in relation to estimated RF dose from mobile phones—results from five Interphone countries	Occup Env Med 2011	http://www.ncbi.nlm.nih.gov/pubmed/21659469	There were suggestions of an increased risk of glioma in long-term mobile phone users with high RF exposure and of similar, but apparently much smaller, increases in meningioma risk. The uncertainty of these results requires that they be replicated before a causal interpretation can be made
Cardis E	2011a	Indications of possible brain-tumour risk in mobile-phone studies: should we be concerned?	Occup Environ Med 2011;68:169-171	http://oem.bmj.com/content/68/3/169.extract	While more studies are needed to confirm or refute these results, indications of an increased risk in high- and long-term users from Interphone and other studies are of concern.
Cardis E	2007	The INTERPHONE study: design, epidemiological methods, and description of the study population	Eur J Epidemiol. 2007;22(9):647-64	http://www.ncbi.nlm.nih.gov/pubmed/17636416	
Carpenter DO	2010	Electromagnetic fields and cancer: the cost of doing nothing	Rev Environ Health. 2010 Jan-Mar; 25(1):75-80	http://www.ncbi.nlm.nih.gov/pubmed/20429163	These data indicate that the existing standards for radiofrequency exposure are not adequate. While there are many unanswered questions, the cost of doing nothing will result in an increasing number of people, many of them young, developing cancer
Carpenter RL	1979	Ocular effects of microwave radiation.	Bulletin of the New York Academy of Medicine, 55(11), 1048-1057.	http://www.ncbi.nlm.nih.gov/pubmed/295242	Having determined the cataractogenic threshold for a single dose, it was found that a microwave dose incapable of producing apparent effects when applied only once might cause a lens opacity if applied repeatedly at regular intervals.
Carrubba S	2010	Mobile-phone pulse triggers evoked potentials	Neurosci Lett. 2010 Jan 18; 469(1):164-8	http://www.ncbi.nlm.nih.gov/pubmed/19961898	The results implied that mobile-phones trigger EP at the rate of 217 Hz during ordinary phone use. Chronic production of the changes in brain activity might be pertinent to the reports of health hazards among mobile-phone users.
Chavdoula ED	2010	Comparison of biological effects between continuous and intermittent exposure to GSM-900-MHz mobile phone radiation: Detection of apoptotic cell-death features	Mutat Res. 2010 Jul 19;700(1-2):51-61. Epub 2010 May 21	http://www.ncbi.nlm.nih.gov/pubmed/20472095	In the present experiments we show that intermittent exposure also decreases the reproductive capacity and alters the actin-cytoskeleton network of the egg chambers, another known aspect of cell death that was not investigated in previous experiments, and that the effect is also due to DNA fragmentation
Christ A	2010	Age-dependent tissue-specific exposure of cell phone users	Physics in Medicine and Biology, 55(7), 1767-1783	http://www.ncbi.nlm.nih.gov/pubmed/20208098	The results show that the locally induced fields in children can be significantly higher (>3 dB) in subregions of the brain (cortex, hippocampus and hypothalamus) and the eye due to the closer proximity of the phone to these tissues.
Christensen HC	2004	Cellular telephone use and risk of acoustic neuroma	Am J Epidemiol. 2004 Feb 1;159(3):277-83	http://www.ncbi.nlm.nih.gov/pubmed/14742288	The results of this prospective, population-based, nationwide study, which included a large number of long-term users of cellular telephones, do not support an association between cell phone use and risk of acoustic neuroma.
Cooke	2010	A case-control study of risk of leukaemia in relation to mobile phone use	British Journal of Cancer (2010), 1 –7	http://www.ncbi.nlm.nih.gov/pubmed/20940717	A non-significantly raised risk was found in people who first used a phone 15 or more years ago (OR%1.87, 95% CI%0.96, 3.63). ... This study suggests that use of mobile phones does not increase leukaemia risk, although the possibility of an effect after long-term use, while biologically unlikely, remains open.
Czerninski R	2011	Risk of Parotid Malignant Tumors in Israel (1970–2006)	Epidemiology: January 2011 - Volume 22 - Issue 1 - pp 130-131	http://journals.lww.com/epidem/Fulltext/2011/01000/Risk_of_Parotid_Malignant_Tumors_in_Israel.25.aspx	The total number of parotid gland cancers in Israel increased 4-fold from 1970 to 2006 (from 16 to 64 cases per year), whereas other major salivary gland cancers remained stable
Czyz J	2004	High frequency electromagnetic fields (GSM signals) affect gene expression levels in tumor suppressor p53-deficient embryonic stem cells	Bioelectromagnetics. 2004 May;25(4):296-307	http://www.ncbi.nlm.nih.gov/pubmed/15114639	Our data indicate that the genetic background determines cellular responses to GSM modulated EMF
D'Ambrosio G	2002	Cytogenetic damage in human lymphocytes following GSMK phase modulated microwave exposure	Bioelectromagnetics. 2002 Jan; 23(1):7-13	http://www.ncbi.nlm.nih.gov/pubmed/11793401	a statistically significant micronucleus effect was found following exposure to phase modulated field. These results would suggest a genotoxic power of the phase modulation per se
D'Costa H	2003	Human brain wave activity during exposure to radiofrequency field emissions from mobile phones	Australas Phys Eng Sci Med. 2003 Dec; 26(4):162-7	http://www.ncbi.nlm.nih.gov/pubmed/14995060	In conclusion, the results of this study lend support to EEG effects from mobile phones activated in talk-mode
De Iuliis GN	2009	Mobile phone radiation induces reactive oxygen species production and DNA damage in human spermatozoa in vitro	PLoS One. 2009 Jul 31; 4(7):e6446	http://www.ncbi.nlm.nih.gov/pubmed/19649291	RF-EMR in both the power density and frequency range of mobile phones enhances mitochondrial reactive oxygen species generation by human spermatozoa, decreasing the motility and vitality of these cells while stimulating DNA base adduct formation and, ultimately DNA fragmentation. These findings have clear implications for the safety of extensive mobile phone use by males of reproductive age, potentially affecting both their fertility and the health and wellbeing of their offspring.

Del Vecchio G	2009b	Effect of radiofrequency electromagnetic field exposure on in vitro models of neurodegenerative disease	Bioelectromagnetics. 2009 Oct; 30(7):564-72	http://www.ncbi.nlm.nih.gov/pubmed/19479910	These data suggest that only under particular circumstances exposure to GSM modulated, 900 MHz signal act as a co-stressor for oxidative damage of neural cells
Del Vecchio G	2009a	Continuous exposure to 900MHz GSM-modulated EMF alters morphological maturation of neural cells	Neurosci Lett. 2009 May 22; 455(3):173-7. Epub 2009 Mar 24	http://www.ncbi.nlm.nih.gov/pubmed/19429115	We found that RF-EMF exposure reduced the number of neurites generated by both cell systems, and this alteration correlates to increased expression of beta-thymosin mRNA
Desai NR	2009	Pathophysiology of cell phone radiation: oxidative stress and carcinogenesis with focus on male reproductive system	Reprod Biol Endocrinol. 2009 Oct 22; 7:114	http://www.ncbi.nlm.nih.gov/pubmed/19849853	This review also addresses: 1) the controversial effects of RF-EMW on mammalian cells and sperm DNA as well as its effect on apoptosis, 2) epidemiological, in vivo animal and in vitro studies on the effect of RF-EMW on male reproductive system, and 3) finally, exposure assessment and dosimetry by computational biomodeling.
de Salles A	2006	Electromagnetic absorption in the head of adults and children due to mobile phone operation close to the head	Electromagn Biol Med. 2006;25(4):349-60.	http://www.ncbi.nlm.nih.gov/pubmed/17178592	The SAR results are compared with the available international recommendations. It is shown that under similar conditions, the 1g-SAR calculated for children is higher than that for the adults. When using the 10-year old child model, SAR values higher than 60% than those for adults are obtained
de Vocht F	2011	Time trends (1998–2007) in brain cancer incidence rates in relation to mobile phone use in England	Bioelectromagnetics, 32: 334–339	http://onlinelibrary.wiley.com/doi/10.1002/bem.20648/abstract;jsessionid=86A660571FA4EEBEF1B1F098F717F4.d01t03	The observed increase in the rate of cancers in the temporal lobe, if caused by mobile phone use, would constitute <1 additional case per 100,000 people in that period. These data do not indicate a pressing need to implement a precautionary principle by means of population-wide interventions to reduce RF exposure from mobile phones
Diem E	2005	Non-thermal DNA breakage by mobile-phone radiation (1800 MHz) in human fibroblasts and in transformed GFSH-R17 rat granulosa cells in vitro	Mutat Res. 2005 Jun 6; 583(2):178-83	http://www.ncbi.nlm.nih.gov/pubmed/15869902	Therefore we conclude that the induced DNA damage cannot be based on thermal effects
Divan H	2010	Cell phone use and behavioural problems in young children	J Epidemiol Community Health. 2010 Dec 7.	http://www.ncbi.nlm.nih.gov/pubmed/21138897	The findings of the previous publication were replicated in this separate group of participants demonstrating that cell phone use was associated with behavioural problems at age 7-14;years in children, and this association was not limited to early users of the technology
Divan H	2008	Prenatal and postnatal exposure to cell phone use and behavioural problems in children	Epidemiology. 2008 Jul; 19(4):523-9	http://www.ncbi.nlm.nih.gov/pubmed/18467962	Exposure to cell phones prenatally-and, to a lesser degree, postnatally-was associated with behavioral difficulties such as emotional and hyperactivity problems around the age of school entry. These associations may be noncausal and may be due to unmeasured confounding. If real, they would be of public health concern given the widespread use of this technology.
Dobes M	2011	A multicenter study of primary brain tumor incidence in Australia (2000–2008)	Neuro-Oncology 13(7):783–790, 2011	http://www.ncbi.nlm.nih.gov/pubmed/21727214	A significant increase in primary malignant brain tumors from 2000 to 2008 was observed; this appears to be largely due to an increase in malignant tumor incidence in the ≥65-year age group.
Donnellan M	1997	Effects of exposure to electromagnetic radiation at 835 MHz on growth, morphology and secretory characteristics of a mast cell analogue, RBL-2H3	Cell Biol Int. 1997 Jul;21(7):427-39	http://www.ncbi.nlm.nih.gov/pubmed/9313343	It is hypothesized that effects of exposure to an electromagnetic field at 835 MHz may be mediated via a signal transduction pathway.
Duan Y	2011	Correlation between cellular phone use and epithelial parotid gland malignancies	International Journal of Oral and Maxillofacial Surgery (in press)	http://www.sciencedirect.com/science/article/pii/S0901502711001172	The results suggest a possible dose–response relationship of cellular phone use with epithelial parotid gland malignancy. The authors suggest that the association of cellular phone use and epithelial parotid gland malignancy and mucoepidermoid carcinoma requires further investigation with large prospective studies
Eberhardt JL	2008	Blood-brain barrier permeability and nerve cell damage in rat brain 14 and 28 days after exposure to microwaves from GSM mobile phones	Electromagn Biol Med. 2008; 27(3):215-29	http://www.ncbi.nlm.nih.gov/pubmed/18821198	Albumin extravasation and also its uptake into neurons was seen to be enhanced after 14 d, but not after a 28 d recovery period. The occurrence of dark neurons in the rat brains, on the other hand, was enhanced later, after 28 d.
Erogul O	2006	Effects of electromagnetic radiation from a cellular phone on human sperm motility: an in vitro study	Arch Med Res 2006 37(7):840-3	http://www.ncbi.nlm.nih.gov/pubmed/16971222	These data suggest that EMR emitted by cellular phone influences human sperm motility. In addition to these acute adverse effects of EMR on sperm motility, long-term EMR exposure may lead to behavioral or structural changes of the male germ cell. These effects may be observed later in life, and they are to be investigated more seriously.
Esen F	2006	Effect of electromagnetic fields emitted by cellular phones on the latency of evoked electrodermal activity	Int J Neurosci. 2006 Mar; 116(3):321-9	http://www.ncbi.nlm.nih.gov/pubmed/16484058	Therefore, the findings point to the potential risks of mobile phones on the function of CNS and consequently, possible increase in the risk of phone-related driving hazards

Esmekaya MA	2010	Pulse modulated 900 MHz radiation induces hypothyroidism and apoptosis in thyroid cells: A light, electron microscopy and immunohistochemical study	Int J Radiat Biol. 2010 Dec;86(12):1106-16. Epub 2010 Sep 1	http://www.ncbi.nlm.nih.gov/pubmed/20807179	The overall findings indicated that whole body exposure to pulse-modulated RF radiation that is similar to that emitted by global system for mobile communications (GSM) mobile phones can cause pathological changes in the thyroid gland by altering the gland structure and enhancing caspase-dependent pathways of apoptosis.
Falzone N	2011	The effect of pulsed 900-MHz GSM mobile phone radiation on the acrosome reaction, head morphometry and zona binding of human spermatozoa	Int J Androl. 2011 Feb;34(1):20-6	http://www.ncbi.nlm.nih.gov/pubmed/20236367	REM had a significant effect on sperm morphometry. In addition, a significant decrease in sperm binding to the hemizona was observed. These results could indicate a significant effect of RF-EMF on sperm fertilization potential.
Fejes I	2005	Is there a relationship between cell phone use and semen quality?	Arch Androl. 2005 Sep-Oct; 51(5):385-93	http://www.ncbi.nlm.nih.gov/pubmed/16087567	The prolonged use of cell phones may have negative effects on the sperm motility characteristics
Ferreira A	2006	Ultra high frequency-electromagnetic field irradiation during pregnancy leads to an increase in erythrocytes micronuclei incidence in rat offspring	Life Sci 2006 Dec 3; 80(1):43-50	http://www.ncbi.nlm.nih.gov/pubmed/16978664	Our results suggest that, under our experimental conditions, UHF-EMF is able to induce a genotoxic response in hematopoietic tissue during the embryogenesis through an unknown mechanism
Fragopoulou AF	2011	Is cognitive function affected by mobile phone radiation exposure?	Eur. J. Oncol. - Library Vol. 5	http://www.medicalinformation.it/ecommerce/non-thermal-effects-and-mechanisms-of-interaction-between-electromagnetic-fields-and-living-matter-an-icems-monograph.html	The recorded data from the literature are generally favouring the conclusion that EMF is affecting memory function although a more rigorous and reproducible exposure system has to be adopted in relation to the recently criticized importance of SAR.
Fragopoulou AF	2010b	Whole body exposure with GSM 900MHz affects spatial memory in mice	Pathophysiology. 2010 Jun; 17(3):179-187	http://www.ncbi.nlm.nih.gov/pubmed/19954937	... exposed mice had deficits in consolidation and/or retrieval of the learned spatial information
Fragopoulou AF	2010a	Cranial and postcranial skeletal variations induced in mouse embryos by mobile phone radiation	Pathophysiology. 2010 Jun; 17(3):169-77	http://www.ncbi.nlm.nih.gov/pubmed/19854628	It is concluded that mild exposure to mobile phone radiation may affect, although transiently, mouse foetal development at the ossification level.
Franzellitti S	2010	Transient DNA damage induced by high-frequency electromagnetic fields (GSM 1.8 GHz) in the human trophoblast HTR-8/SVneo cell line evaluated with the alkaline comet assay.	Mutat Res 2010 Jan 5; 683(1-2):35-42.	http://www.ncbi.nlm.nih.gov/pubmed/19822160	Our data suggest that HF-EMF with a carrier frequency and modulation scheme typical of the GSM signal may affect the DNA integrity
Franzellitti S	2009	Effect of high-frequency electromagnetic fields on trophoblastic connexins	Reprod Toxicol 2009 Jul; 28(1):59-65	http://www.ncbi.nlm.nih.gov/pubmed/19490996	This study is the first to indicate that exposure of extravillous trophoblast to GSM-217 Hz signals can modify Cx gene expression, Cx protein localization and cellular ultrastructure
Franzellitti S	2008	HSP70 Expression in Human Trophoblast Cells Exposed to Different 1.8 GHz Mobile Phone Signals	Rad. Res. 2008 Oct; 170(4): 488-497	http://www.ncbi.nlm.nih.gov/pubmed/19024656	The present results suggest that the expression analysis for multiple transcripts, though encoding the same or similar protein products, can be highly informative and may account for subtle changes not detected at the protein level
Frei P	2011	Use of mobile phones and risk of brain tumours: update of Danish cohort study	BMJ 2011;343:d6387 doi: 10.1136/bmj.d6387	http://www.ncbi.nlm.nih.gov/pubmed/22016439	In this update of a large nationwide cohort study of mobile phone use, there were no increased risks of tumours of the central nervous system, providing little evidence for a causal association
Friedman J	2007	Mechanism of a short-term ERK activation by electromagnetic fields at mobile phone frequency	Biochem J. 2007 Aug 1; 405(3):559-68	http://www.ncbi.nlm.nih.gov/pubmed/17456048	Thus this study demonstrates for the first time a detailed molecular mechanism by which electromagnetic irradiation from mobile phones induces the activation of the ERK cascade and thereby induces transcription and other cellular processes
Gandhi O	2011	Exposure Limits: The underestimation of absorbed cell phone radiation, especially in children	Electromagnetic Biology and Medicine, Early Online: 1-18, 2011	http://informahealthcare.com/loi/ebm	When electrical properties are considered, a child's head's absorption can be over two times greater, and absorption of the skull's bone marrow can be ten times greater than adults.
Gandhi O	2002	Some present problems and a proposed experimental phantom for SAR compliance testing of cellular telephones at 835 and 1900 MHz	Phys. Med. Biol. 47:1501-1508	http://www.ncbi.nlm.nih.gov/pubmed/12043816	The SARs obtained with the insulating plastic ear models are up to two or more times smaller than realistic anatomic models. We propose a 2 mm thin shell phantom with lossy ear that should give SARs within +/- 15% of those of anatomic models.
Gandhi O	1996	Electromagnetic absorption in the human head and neck for mobile telephones at 835 and 1900 MHz	Ieee transactions on microwave theory and techniques	http://ieeexplore.ieee.org/xpl/freeabs_all.jsp?arnumber=539947	... peak one-voxel and 1-g SARs are larger for the smaller models of children, particularly at 835 MHz. Also, a larger in-depth penetration of absorbed energy for these smaller models is obtained.
Gee D	2009	Late Lessons from Early Warnings: Towards realism and precaution with EMF?	Pathophysiology. 2009 Aug;16(2-3):217-31.	http://www.ncbi.nlm.nih.gov/pubmed/19467848	These issues are relevant to the risk assessment of electromagnetic fields (EMF). Some implications of these issues and of the "late lessons" for the evaluation and reduction of risks from EMF are indicated.

George DF	2008	Non-thermal effects in the microwave induced unfolding of proteins observed by chaperone binding	Bioelectromagnetics. 2008 May; 29(4):324-30	http://www.ncbi.nlm.nih.gov/pubmed/18240290	We show that microwaves cause a significantly higher degree of unfolding than conventional thermal stress for protein solutions heated to the same maximum temperature
Gerner C	2010	Increased protein synthesis by cells exposed to a 1,800-MHz radio-frequency mobile phone electromagnetic field, detected by proteome proWling	Int Arch Occup Environ Health. 2010 Aug;83(6):691-702	http://www.ncbi.nlm.nih.gov/pubmed/20145945	Our finding of an association between metabolic activity and the observed cellular reaction to low intensity RF-EMF may reconcile conflicting results of previous studies. We further postulate that the observed increased protein synthesis reflects an increased rate of protein turnover stemming from protein folding problems caused by the interference of radio-frequency electromagnetic fields with hydrogen bonds. Our observations do not directly imply a health risk. However, vis-a-vis a synopsis of reports on cells stress and DNA breaks, after short and longer exposure, on active and inactive cells, our findings may contribute to the re-evaluation of previous reports
Girgert R	2010	Signal transduction of the melatonin receptor MT1 is disrupted in breast cancer cells by electromagnetic fields.	Bioelectromagnetics. 2010 Apr;31(3):237-45	http://www.ncbi.nlm.nih.gov/pubmed/19882681	These results convincingly prove the negative effect of EMF on the antiestrogenic effect of melatonin in breast cancer cells
Goldwein O	2010	The influence of handheld mobile phones on human parotid gland secretion	Oral Dis. 2010 Mar; 16(2):146-50	http://www.ncbi.nlm.nih.gov/pubmed/19744173	Parotid glands adjacent to handheld MPH in use respond by elevated salivary rates and decreased protein secretion reflecting the continuous insult to the glands. This phenomenon should be revealed to the worldwide population and further exploration by means of large-scale longitudinal studies is warranted
Grigor'ev luG	2003	Biological effects of mobile phone electromagnetic field on chick embryo (risk assessment using the mortality rate)	Radiats Biol Radioecol. 2003 Sep-Oct; 43(5):541-3	http://www.ncbi.nlm.nih.gov/pubmed/14658287	Chicken embryos were exposed to EMF from GSM mobile phone during the embryonic development (21 days). As a result the embryo mortality rate in the incubation period increased to 75% (versus 16% in control group).
Gul A	2009	The effects of microwave emitted by cellular phones on ovarian follicles in rats	Arch Gynecol Obstet. 2009 Nov; 280(5):729-33	http://www.ncbi.nlm.nih.gov/pubmed/19241083	The analysis revealed that in the study group, the number of follicles was lower than that in the control group. The decreased number of follicles in pups exposed to mobile phone microwaves suggest that intrauterine exposure has toxic effects on ovaries.
Guler G	2010	Apoptosis resulted from radiofrequency radiation exposure of pregnant rabbits and their infants	Bull Vet Inst Pulawy 55, 127-134, 2011	http://bulletin.piwet.pulawy.pl/index.php/archive-pdf-a-abstracts/75/104-bull-vet-inst-pulawy-55-127-134-2011	Apoptotic cells were detected in the brain, eyes, kidneys, liver, lung, heart, and spleen by terminal deoxynucleotidyl transferase-mediated dUTP nick end-labelling (TUNEL) staining. Histopathological changes were observed in the examined organs. TUNEL positivity was seen in the brain (group VI) and eyes (groups IV and VI). In groups I, II, III, and V, the positivity was lesser than 5% and was not taken into account
Guler G	2008	The protective effects of N-acetyl-L-cysteine and epigallocatechin-3-gallate on electric field-induced hepatic oxidative stress	Int J Radiat Biol. 2008 Aug;84(8):669-80	http://www.ncbi.nlm.nih.gov/pubmed/18661381	To conclude, extremely low frequency (ELF) electric field has potential harmful effects on the living organisms by enhancing the free radical production. NAC and EGCG might have hepatoprotective effects in ELF-E field induced oxidative and nitrosative stress
Gutschi T	2011	Impact of cell phone use on men's semen parameters	Andrologia. 2011 Mar 28	www.ncbi.nlm.nih.gov/pubmed/21486411	Our results showed that cell phone use negatively affects sperm quality in men. Further studies with a careful design are needed to determine the effect of cell phone use on male fertility
Han YY	2010b	Generational Risks for Cancers Not Related to Tobacco, Screening, or Treatment in the United States	Cancer. 2010 Feb 15;116(4):940-8	http://www.ncbi.nlm.nih.gov/pubmed/20052736	Despite declining overall cancer death rates, adults are experiencing increased incidence of cancers that are not associated with tobacco or screening relative to their parents.
Han YY	2010a	Temporal and demographic patterns of non-Hodgkin's lymphoma incidence in Pennsylvania	Int J Occup Environ Health. 2010 Jan-Mar;16(1):75-84	http://www.ncbi.nlm.nih.gov/pubmed/20166322	Diffuse lymphoma appeared to be the major contributor to the increases. NHL incidence was higher in Pennsylvania counties with greater percentages of urban residents
Han YY	2009	Cell phone use and acoustic neuroma: the need for standardized questionnaires and access to industry data.	Surg Neurol. 2009 Sep;72(3):216-22	http://www.ncbi.nlm.nih.gov/pubmed/19328527	Most studies did not find association between the development of AN and cell phone use, but some studies that followed cases for 10 years or more did show an association
Hardell L	2011	Pooled analysis of case-control studies on malignant brain tumours and the use of mobile and cordless phones including living and deceased subjects	Int J Oncol. 2011 May;38(5):1465-74. doi: 10.3892/ijo.2011.947. Epub 2011 Feb 17	http://www.ncbi.nlm.nih.gov/pubmed/21331446	Highest risk was found for the most common type of glioma, astrocytoma, yielding in the >10 year latency group for mobile phone use odds ratio (OR) = 2.7 In a separate analysis, these phone types were independent risk factors for glioma. The risk for astrocytoma was highest in the group with first use of a wireless phone before the age of 20; mobile phone use OR = 4.9, cordless phone use OR = 3.9. In conclusion, an increased risk was found for glioma and use of mobile or cordless phone. The risk increased with latency time and cumulative use in hours and was highest in subjects with first use before the age of 20.

Hardell L	2009b	Epidemiological evidence for an association between use of wireless phones and tumor diseases	Pathophysiology. 2009 Aug; 16(2-3):113-22	http://www.ncbi.nlm.nih.gov/pubmed/19268551	In summary our review yielded a consistent pattern of an increased risk for glioma and acoustic neuroma after >10 year mobile phone use. We conclude that current standard for exposure to microwaves during mobile phone use is not safe for long-term exposure and needs to be revised.
Hardell L	2009a	Mobile phones, cordless phones and the risk for brain tumours	Int J Oncol. 2009 Jul; 35(1):5-17.	http://www.ncbi.nlm.nih.gov/pubmed/19513546	Overall highest OR for mobile phone use was found in subjects with first use at age <20 years
Hardell L	2008b	Meta-analysis of long-term mobile phone use and the association with brain tumours	Int J Oncol. 2008 May; 32(5):1097-103	http://www.ncbi.nlm.nih.gov/pubmed/18425337	We conclude that this meta-analysis gave a consistent pattern of an association between mobile phone use and ipsilateral glioma and acoustic neuroma using > or =10-years latency period
Hardell L	2008a	Biological effects from electromagnetic field exposure and public exposure standards	Biomed Pharmacother. 2008 Feb; 62(2):104-9	http://www.ncbi.nlm.nih.gov/pubmed/18242044	Since use of mobile phones is associated with an increased risk for brain tumour after 10 years, a new biologically based guideline is warranted.
Hardell L	2007b	Long-term use of cellular phones and brain tumours - increased risk associated with use for > 10 years	Occup Environ Med. 2007 Sep; 64(9):626-32	http://www.ncbi.nlm.nih.gov/pubmed/17409179	Results from present studies on use of mobile phones for > or =10 years give a consistent pattern of increased risk for acoustic neuroma and glioma. The risk is highest for ipsilateral exposure
Hardell L	2007a	Use of cellular and cordless telephones and risk of testicular cancer	Int J Androl. 2007 Apr;30(2):115-22.	http://www.ncbi.nlm.nih.gov/pubmed/17209885	Regarding seminoma the use of analog cellular phones gave odds ratio (OR) = 1.2 ... digital phones OR = 1.3 ... and cordless phones OR = 1.1 ... The corresponding results for non-seminoma were OR = 0.7 ... OR = 0.9 ... and OR = 1.0 ... respectively. There was no dose-response effect and OR did not increase with latency time. No association was found with place of keeping the mobile phone during standby, such as trousers pocket.
Hardell L	2006c	Tumour risk associated with use of cellular telephones or cordless desktop telephones	World J Surg Oncol 2006 Oct 11;4:74	http://www.ncbi.nlm.nih.gov/pubmed/17034627	Since the second part of the 1990's we have performed six case-control studies on this topic encompassing use of both cellular and cordless phones as well as other exposures. We found for all studied phone types an increased risk for brain tumours, mainly acoustic neuroma and malignant brain tumours. OR increased with latency period, especially for astrocytoma grade III-IV. No consistent pattern of an increased risk was found for salivary gland tumours, NHL, or testicular cancer
Hardell L	2006b	Pooled analysis of two case-control studies on use of cellular and cordless telephones and the risk for malignant brain tumours diagnosed in 1997-2003	Int Arch Occup Environ Health. 2006 Sep; 79(8):630-9	http://www.ncbi.nlm.nih.gov/pubmed/16541280	Increased risk was obtained for both cellular and cordless phones, highest in the group with >10 years latency period
Hardell L	2006a	Case-control study of the association between the use of cellular and cordless telephones and malignant brain tumors diagnosed during 2000-2003	Environ Res. 2006 Feb; 100(2):232-41	http://www.ncbi.nlm.nih.gov/pubmed/16023098	The use of analog cellular phones yielded odds ratio (OR) of 2.6 ... increasing to OR=3.5 ... with a >10-year latency period. Regarding digital cellular telephones, the corresponding results were OR=1.9 ... and OR=3.6 ... respectively. Cordless telephones yielded OR=2.1, 95% ... and with a >10-year latency period, OR=2.9.
Hardell L	2005	Use of cellular or cordless telephones and the risk for non-Hodgkin's lymphoma	Int Arch Occup Environ Health. 2005 Sep; 78(8):625-32	http://www.ncbi.nlm.nih.gov/pubmed/16001209	The results indicate an association between T-cell NHL and the use of cellular and cordless telephones, however based on low numbers and must be interpreted with caution. Regarding B-cell NHL no association was found
Hardell L	2004	Cellular and cordless telephone use and the association with brain tumors in different age groups	Arch Environ Health. 2004 Mar;59(3):132-7	http://www.ncbi.nlm.nih.gov/pubmed/16121902	Use of analog cellular telephones yielded an odds ratio (OR) for brain tumors of 1.31, 95% confidence interval (CI) = 1.04-1.64, increasing for ipsilateral use to OR = 1.65, 95% CI = 1.19-2.30. The authors found the highest risk for the 20-29-yr age group, with OR = 5.91, 95% CI = 0.63-55 for ipsilateral use of analog phones. The highest risks were associated with >5-year latency period in the 20-29-yr age group for analog phones (OR = 8.17, 95% CI = 0.94-71), and cordless phones (OR = 4.30, 95% CI = 1.22-15).
Hardell L	2003b	Vestibular schwannoma, tinnitus and cellular telephones	Neuroepidemiology 2003 Mar-Apr; 22(2):124-9	http://www.ncbi.nlm.nih.gov/pubmed/12629278	Cases with tinnitus after using analogue cellular telephones are presented. An increased odds ratio of 3.45, 95% confidence interval (CI) 1.77-6.76, was found for vestibular schwannoma (VS) associated with the use of analogue cell phones.
Hardell L	2003a	Further aspects on cellular and cordless telephones and brain tumours	Int J Oncol. 2003 Feb; 22(2):399-407	http://www.ncbi.nlm.nih.gov/pubmed/12527940	There was a tendency of a shorter tumour induction period for ipsilateral exposure to microwaves than for contralateral, which may indicate a tumour promotor effect
Hardell L	2002b	Cellular and cordless telephones and the risk for brain tumours	Eur J Cancer Prev. 2002 Aug;11(4):377-86.	http://www.ncbi.nlm.nih.gov/pubmed/12195165	In total, use of analogue cellular telephones gave an increased risk with an odds ratio (OR) of 1.3 (95% confidence interval (CI) 1.02-1.6). With a tumour induction period of >10 years the risk increased further: OR 1.8 (95% CI 1.1-2.9)
Hardell L	2002a	Case-control study on the use of cellular and cordless phones and the risk for malignant brain tumours	Int J Radiat Biol. 2002 Oct;78(10):931-6	http://www.ncbi.nlm.nih.gov/pubmed/12465658	The ipsilateral use of an analogue cellular phone yielded a significantly increased risk for malignant brain tumours

Hardell L	1999	Use of cellular telephones and the risk for brain tumours: A case-control study	Int J Oncol. 1999 Jul;15(1):113-6	http://www.ncbi.nlm.nih.gov/pubmed/10375602	For GSM use the observation time is still too short for definite conclusions. An increased risk for brain tumour in the anatomical area close to the use of a cellular telephone should be especially studied in the future
Hepworth SJ	2006	Mobile phone use and risk of glioma in adults: case-control study	BMJ. 2006 Apr 15;332(7546):883-7. Epub 2006 Jan 20	http://www.ncbi.nlm.nih.gov/pubmed/16428250	Use of a mobile phone, either in the short or medium term, is not associated with an increased risk of glioma. This is consistent with most but not all published studies. The complementary positive and negative risks associated with ipsilateral and contralateral use of the phone in relation to the side of the tumour might be due to recall bias
Hours M	2011	Cell Phones and Risk of brain and acoustic nerve tumours: the French INTERPHONE case-control study	Rev Epidemiol Sante Publique. 2007 Oct;55(5):321-32. Epub 2007 Sep 11	http://www.ncbi.nlm.nih.gov/pubmed/17851009	No significant increased risk for glioma, meningioma or neuroma was observed among cell phone users participating in Interphone. The statistical power of the study is limited, however
Hruby R	2008	Study on potential effects of "902-MHz GSM-type Wireless Communication Signals" on DMBA-induced mammary tumours in Sprague-Dawley rats	Mutat Res 2008; 649:34-44	http://www.ncbi.nlm.nih.gov/pubmed/17981079	The significant differences between the sham-exposed animals and one or more RF-exposed groups may be interpreted as evidence of an effect of RF-exposure. In the context of the results of the cage-control group, in the light of controversial results reported in the literature, and given the fact that the DMBA-mammary tumour model is known to be prone to high variations in the results, it is the authors' opinion that the differences between the groups are rather incidental ones.
Huber R	2003	Radio frequency electromagnetic field exposure in humans: Estimation of SAR distribution in the brain, effects on sleep and heart rate	Bioelectromagnetics. 2003 May; 24(4):262-76	http://www.ncbi.nlm.nih.gov/pubmed/12696086	Exposure during sleep reduced waking after sleep onset and affected heart rate variability. Exposure prior to sleep reduced heart rate during waking and stage 1 sleep
Huber R	2000	Exposure to pulsed high-frequency electromagnetic field during waking affects human sleep EEG	Neuroreport. 2000 Oct 20; 11(15):3321-5	http://www.ncbi.nlm.nih.gov/pubmed/11059895	The present results demonstrate that exposure during waking modifies the EEG during subsequent sleep. Thus the changes of brain function induced by pulsed high-frequency EMF outlast the exposure period.
Hung CS	2007	Mobile phone 'talk-mode' signal delays EEG-determined sleep onset	Neurosci Lett. 2007 Jun 21; 421(1):82-6	http://www.ncbi.nlm.nih.gov/pubmed/17548154	Post-exposure, sleep latency after talk mode was markedly and significantly delayed beyond listen and sham modes. This condition effect over time was also quite evident
Huss A	2007	Source of funding and results of studies of health effects of mobile phone use: systematic review of experimental studies.	Environmental Health Perspectives, 115(1), 1-4.	http://www.ncbi.nlm.nih.gov/pubmed/17366811	Studies funded exclusively by industry reported the largest number of outcomes, but were least likely to report a statistically significant result: The odds ratio was 0.11 (95% confidence interval, 0.02-0.78), compared with studies funded by public agencies or charities. The interpretation of results from studies of health effects of radiofrequency radiation should take sponsorship into account.
Hyland G	2000	Physics and biology of mobile telephony	Lancet. 2000 Nov 25;356(9244):1833-6	http://www.ncbi.nlm.nih.gov/pubmed/11117927	Notwithstanding uncertainty about whether the non-thermal influences reported do adversely affect health, there are consistencies between some of these effects and the neurological problems reported by some mobile-telephone users and people exposed longterm to base-station radiation
Inskip PD	2001	Cellular-telephone use and brain tumors	N Engl J Med. 2001 Jan 11;344(2):79-86	http://www.ncbi.nlm.nih.gov/pubmed/11150357	These data do not support the hypothesis that the recent use of hand-held cellular telephones causes brain tumors, but they are not sufficient to evaluate the risks among long-term, heavy users and for potentially long induction periods.
Interphone group	2010	Brain tumour risk in relation to mobile telephone use: results of the INTERPHONE international case-control study	Int J Epidemiol. 2010 Jun;39(3):675-94. Epub 2010 May 17	http://www.ncbi.nlm.nih.gov/pubmed/20483835	Overall, no increase in risk of glioma or meningioma was observed with use of mobile phones. There were suggestions of an increased risk of glioma at the highest exposure levels, but biases and error prevent a causal interpretation. The possible effects of long-term heavy use of mobile phones require further investigation
Johannessen TB	2004	Trends in incidence of brain and central nervous system tumors in Norway, 1970-1999	Neuroepidemiology. 2004 May-Jun;23(3):101-9	http://www.ncbi.nlm.nih.gov/pubmed/15084778	The overall rate of brain and CNS tumors increased during the study period from 6.49 to 12.02 cases per 100,000 person-years.
Johansen C	2001	Cellular telephones and cancer--a nationwide cohort study in Denmark	J Natl Cancer Inst. 2001 Feb 7;93(3):203-7	http://www.ncbi.nlm.nih.gov/pubmed/11158188	The results of this investigation, the first nationwide cancer incidence study of cellular phone users, do not support the hypothesis of an association between use of these telephones and tumors of the brain or salivary gland, leukemia, or other cancers.
Joubert V	2008	Apoptosis is Induced by Radiofrequency Fields through the Caspase-Independent Mitochondrial Pathway in Cortical Neurons	Radiat Res. 2008 Jan; 169(1):38-45	http://www.ncbi.nlm.nih.gov/pubmed/18159956	Our results show that, under the experimental conditions used, exposure of primary rat neurons to CW RF fields may induce a caspase-independent pathway to apoptosis that involves AIF

Juutilainen J	2011	Experimental Studies on Carcinogenicity of Radiofrequency Radiation in Animals	Critical Reviews in Environmental Science and Technology, 41:1664–1695	http://www.ingentaconnect.com/content/tandf/best/2011/00000041/00000018/art00002	Overall, the results of these studies are rather consistent and indicate no carcinogenic effects at exposure levels relevant to human exposure from mobile phones. This finding is consistent with the results of the majority of epidemiological studies on mobile phone users, and suggests that RF field exposure below the present guidelines is not likely to cause cancer.
Kang G	2002	SARs for pocket-mounted mobile telephones at 835 and 1900 MHz	Phys.Med. Biol. 47:4301–4313.	http://www.ncbi.nlm.nih.gov/pubmed/12502051	This implies that a telephone tested for SAR compliance against the model of the head may be severely out of compliance if it were placed in the shirt pocket.
Karaca E	2011	The genotoxic effect of radiofrequency waves on mouse brain	J Neurooncol. 2011 Jul 6	http://www.ncbi.nlm.nih.gov/pubmed/21732071	It was found that MNI rate increased 11-fold and STAT3 expression decreased 7-fold in the cell cultures which were exposed to RF. Cell phones which spread RF may damage DNA and change gene expression in brain cells
Karinen A	2008	Mobile phone radiation might alter protein expression in human skin	BMC Genomics. 2008 Feb 11; 9:77	http://www.ncbi.nlm.nih.gov/pubmed/18267023	This is the first study showing that molecular level changes might take place in human volunteers in response to exposure to RF-EMF. Our study confirms that proteomics screening approach can identify protein targets of RF-EMF in human volunteers.
Kaufman	2009	Risk factors for leukemia	Thailand Ann Hematol 88(11):1079–1088.	http://www.ncbi.nlm.nih.gov/pubmed/19294385	There was no clear association with cellular telephone phone use, but durations were relatively short (median 24-26 months), and there was a suggestion that risk may be increased for those with certain usage practices ... and those who used GSM service
Kesari KK	2011	Effects of radiofrequency electromagnetic wave exposure from cellular phones on the reproductive pattern in male wistar rats	Appl Biochem Biotechnol. 2011 Jun;164(4):546-59	http://www.ncbi.nlm.nih.gov/pubmed/21240569	Our findings on antioxidant, malondialdehyde, histone kinase, micronuclei, and sperm cell cycle are clear indications of an infertility pattern, initiated due to an overproduction of reactive oxygen species. It is concluded that radiofrequency electromagnetic wave from commercially available cell phones might affect the fertilizing potential of spermatozoa.
Kesari KK	2010	Mobile phone usage and male infertility in Wistar rats	Indian J Exp Biol. 2010 Oct;48(10):987-92	http://www.ncbi.nlm.nih.gov/pubmed/21299041	A significant decrease in protein kinase C and total sperm count along with increased apoptosis were observed in male Wistar rats exposed to mobile phone frequencies
Kheifets L	2005	Developing policy in the face of scientific uncertainty: interpreting 0.3 microT or 0.4 microT cutpoints from EMF epidemiologic studies	Risk Anal. 2005 Aug;25(4):927-35	http://www.ncbi.nlm.nih.gov/pubmed/16268940	Establishment of arbitrary numeric exposure limits undermines the value of both the science-based numeric EMF exposure standards for acute exposures and precautionary approaches
Khurana VG	2009	Cell phones and brain tumors: a review including the long-term epidemiologic data	Surg Neurol. 2009 Sep;72(3):205-14; discussion 214-5. Epub 2009 Mar 27	http://www.ncbi.nlm.nih.gov/pubmed/19328536	The authors conclude that there is adequate epidemiologic evidence to suggest a link between prolonged cell phone usage and the development of an ipsilateral brain tumor.
Khurana VG	2010	Epidemiological evidence for a health risk from mobile phone base stations.	International Journal of Occupational and Environmental Health, 16(3), 263-267.	http://www.ncbi.nlm.nih.gov/pubmed/20662418	By searching PubMed, we identified a total of 10 epidemiological studies that assessed for putative health effects of mobile phone base stations. We found that eight of the 10 studies reported increased prevalence of adverse neurobehavioral symptoms or cancer in populations living at distances < 500 meters from base stations.
Klaebo L	2007	Use of mobile phones in Norway and risk of intracranial tumours	Eur J Cancer Prev. 2007 Apr;16(2):158-64	http://www.ncbi.nlm.nih.gov/pubmed/17297392	The results from the present study indicate that use of mobile phones is not associated with an increased risk of gliomas, meningiomas or acoustic neuromas
Koivisto M	2000	The effects of electromagnetic field emitted by GSM phones on working memory	Neuroreport. 2000 Jun 5; 11(8):1641-3	http://www.ncbi.nlm.nih.gov/pubmed/10852216	The RF field speeded up response times when the memory load was three items but no effects of RF were observed with lower loads. The results suggest that RF fields have a measurable effect on human cognitive performance and encourage further studies on the interactions of RF fields with brain function
Kramareno A	2003	Effects of high-frequency electromagnetic fields on human EEG: a brain mapping study	Int J Neurosci. 2003 Jul; 113(7):1007-19	http://www.ncbi.nlm.nih.gov/pubmed/12881192	The results suggested that cellular phones may reversibly influence the human brain, inducing abnormal slow waves in EEG of awake persons
Krause CM	2007	Effects of pulsed and continuous wave 902 MHz mobile phone exposure on brain oscillatory activity during cognitive processing	Bioelectromagnetics 2007 May; 28(4):296-308	http://www.ncbi.nlm.nih.gov/pubmed/17203478	The effects on the EEG were, however, varying, unsystematic and inconsistent with previous reports. We conclude that the effects of EMF on brain oscillatory responses may be subtle, variable and difficult to replicate for unknown reasons
Krause CM	2006	Mobile phone effects on children's event-related oscillatory EEG during an auditory memory task	Int J Radiat Biol 2006 Jun; 82(6):443-50	http://www.ncbi.nlm.nih.gov/pubmed/16846979	The current findings suggest that EMF emitted by mobile phones has effects on brain oscillatory responses during cognitive processing in children
Krey JF	2007	Molecular mechanisms of autism: a possible role for Ca2+ signaling	Curr Opin Neurobiol. 2007 Feb;17(1):112-9. Epub 2007 Feb 1.	http://www.ncbi.nlm.nih.gov/pubmed/17275285	These recent advances suggest a set of signaling pathways that might have a role in generating these increasingly prevalent disorders

Kuhn S	2009	Assessment of the radio-frequency electromagnetic fields induced in the human body from mobile phones used with hands-free kits	Phys Med Biol 2009; 54:5493-508.	http://www.ncbi.nlm.nih.gov/pubmed/19706964	In general, a wired HFK [hands free kit] considerably reduces the exposure of the entire head region compared to mobile phones operated at the head, even under unlikely worst-case coupling scenarios.
Kundi M	2011	Time Trends (1998-2007) in Brain Cancer Incidence Rates in Relation to Mobile Phone Use in England'	Bioelectromagnetics. 2011 May 24	http://www.ncbi.nlm.nih.gov/pubmed/21611956	In my opinion, it cannot be dismissed from the data presented that the increase in temporal lobe malignant brain tumors (and maybe to some degree also frontal lobe tumors) is partly due to mobile phone use.
Kundi M	2009	The controversy about a possible relationship between mobile phone use and cancer	Environ Health Perspect. 2009 Mar; 117(3):316-24	http://www.ncbi.nlm.nih.gov/pubmed/19337502	The overall evidence speaks in favor of an increased risk, but its magnitude cannot be assessed at present because of insufficient information on long-term use
Kuster N	2009	Past, current, and future research on the exposure of children	Foundation for Research on Information Technology in Society (IT ² S), Foundation Internal Report 2009	http://www.itis.ethz.ch/	[Spatial peak SAR of the CNS of children is] significantly larger (~2x) because the RF source is closer and skin and bone layers are thinner. ... Bone marrow exposure strongly varies with age and is significantly larger for children(~10x).
Kwon MS	2011b	No effects of short-term GSM mobile phone radiation on cerebral blood flow measured using positron emission tomography.	Bioelectromagnetics. 2011 Sep 19.	http://www.ncbi.nlm.nih.gov/pubmed/21932437	The results provided no evidence for acute effects of short-term mobile phone radiation on cerebral blood flow.
Kwon MS	2011a	GSM mobile phone radiation suppresses brain glucose metabolism.	J Cereb Blood Flow Metab. 2011 Sep 14.	http://www.ncbi.nlm.nih.gov/pubmed/21915135	Our results show that short-term mobile phone exposure can locally suppress brain energy metabolism in humans
Lahkola A	2008	Meningioma and mobile phone use--a collaborative case-control study in five North European countries	Int J Epidemiol. 2008 Dec;37(6):1304-13. Epub 2008 Aug 2	http://www.ncbi.nlm.nih.gov/pubmed/18676984	Our results do not provide support for an association between mobile phone use and risk of meningioma
Lahkola A	2006	Meta-analysis of mobile phone use and intracranial tumors	Scand J Work Environ Health. 2006 Jun;32(3):171-7	http://www.ncbi.nlm.nih.gov/pubmed/16804618	The totality of evidence does not indicate a substantially increased risk of intracranial tumors from mobile phone use for a period of at least 5 years
Lai H	2007	Evidence For Genotoxic Effects (RFR AND ELF Genotoxicity)	Bio-Initiative Report Section 6	http://www.bioinitiative.org/freeaccess/report/docs/section_6.pdf	From this literature survey, since only 50% of the studies reported effects, it is apparent that there is no consistent pattern that radiofrequency radiation exposure could induce genetic damages/changes in cells and organisms. However, one can conclude that under certain conditions of exposure, radiofrequency radiation is genotoxic.
Lai H	1996	Single- and double-strand DNA breaks in rat brain cells after acute exposure to radiofrequency electromagnetic radiation	Int J Radiat Biol. 1996 Apr;69(4):513-21	http://www.ncbi.nlm.nih.gov/pubmed/8627134	Our data further support the results of earlier in vitro and in vivo studies showing effects of radiofrequency electromagnetic radiation on DNA
Lai H	1995	Acute low-intensity microwave exposure increases DNA single-strand breaks in rat brain cells	Bioelectromagnetics. 1995;16(3):207-10	http://www.ncbi.nlm.nih.gov/pubmed/7677797	Furthermore, in rats exposed for 2 h to continuous-wave 2450 MHz microwaves (SAR 1.2 W/kg), increases in brain cell DNA single-strand breaks were observed immediately as well as at 4 h postexposure
Lai H	1994	Microwave irradiation affects radial-arm maze performance in the rat	Bioelectromagnetics. 1994; 15(2):95-104	http://www.ncbi.nlm.nih.gov/pubmed/8024608	These data indicate that both cholinergic and endogenous opioid neurotransmitter systems in the brain are involved in the microwave-induced spatial memory deficit
Lerchl A	2008	Effects of mobile phone electromagnetic fields at nonthermal SAR values on melatonin and body weight of Djungarian hamsters (Phodopus sungorus)	J Pineal Res. 2008 Apr; 44(3):267-72	http://www.ncbi.nlm.nih.gov/pubmed/18339122	The results corroborate earlier findings which have shown no effects of RF-EMF on melatonin levels in vivo and in vitro. The data are in accordance with the hypothesis that absorbed RF energy may result in metabolic changes which eventually cause body weight increases in exposed animals
Leszczynski D	2002	Non-thermal activation of the hsp27/p38MAPK stress pathway by mobile phone radiation in human endothelial cells: molecular mechanism for cancer- and blood-brain barrier-related effects	Differentiation. 2002 May; 70(2-3):120-9	http://www.ncbi.nlm.nih.gov/pubmed/12076339	We postulate that these events, when occurring repeatedly over a long period of time, might become a health hazard because of the possible accumulation of brain tissue damage. Furthermore, our hypothesis suggests that other brain damaging factors may co-participate in mobile phone radiation-induced effects
Levis AG	2011	Mobile phones and head tumours. The discrepancies in cause-effect relationships in the epidemiological studies - how do they arise?	Environ Health. 2011; 10: 59.	http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3146917/	Our analysis of the literature studies and of the results from meta-analyses of the significant data alone shows an almost doubling of the risk of head tumours induced by long-term mobile phone use or latency.

Li M	2008	Elevation of plasma corticosterone levels and hippocampal glucocorticoid receptor translocation in rats: a potential mechanism for cognition impairment following chronic low-power-density microwave exposure	J. Radiat Res 49(2), 163-170	http://www.ncbi.nlm.nih.gov/pubmed/18198477	Our results show that MW-exposed rats had significant deficits in spatial learning and memory performance
Lonn S	2005	Long-term mobile phone use and brain tumor risk	Am J Epidemiol. 2005 Mar 15;161(6):526-35	http://www.ncbi.nlm.nih.gov/pubmed/15746469	This study includes a large number of long-term mobile phone users, and the authors conclude that the data do not support the hypothesis that mobile phone use is related to an increased risk of glioma or meningioma
Lönn S	2004	Mobile phone use and the risk of acoustic neuroma	Epidemiology. 2004 Nov;15(6):653-9	http://www.ncbi.nlm.nih.gov/pubmed/15475713	Our findings do not indicate an increased risk of acoustic neuroma related to short-term mobile phone use after a short latency period. However, our data suggest an increased risk of acoustic neuroma associated with mobile phone use of at least 10 years' duration
Lopez-Martin E	2009	The action of pulse-modulated GSM radiation increases regional changes in brain activity and c-Fos expression in cortical and subcortical areas in a rat model of picrotoxin-induced seizure proneness	J Neurosci Res. 2009 May 1; 87(6):1484-99	http://www.ncbi.nlm.nih.gov/pubmed/19115403	These results suggest a specific effect of the pulse modulation of GSM radiation on brain activity of a picrotoxin-induced seizure-proneness rat model and indicate that this mobile-phone-type radiation might induce regional changes in previous preexcitability conditions of neuronal activation
Luria R	2009	Cognitive effects of radiation emitted by cellular phones: The influence of exposure side and time	Bioelectromagnetics. 2009 Apr; 30(3):198-204	http://www.ncbi.nlm.nih.gov/pubmed/19194860	These results confirmed the existence of an effect of exposure on RT, as well as the fact that exposure duration (together with the responding hand and the side of exposure) may play an important role in producing detectable RFR effects on performance
Mailankot M	2009	Radio frequency electromagnetic radiation (RF-EMR) from GSM (0.9/1.8GHz) mobile phones induces oxidative stress and reduces sperm motility in rats	Clinics (Sao Paulo). 2009; 64(6):561-5	http://www.ncbi.nlm.nih.gov/pubmed/19578660	Given the results of the present study, we speculate that RF-EMR from mobile phones negatively affects semen quality and may impair male fertility
Manti L	2008	Effects of Modulated Microwave Radiation at Cellular Telephone Frequency (1.95 GHz) on X-Ray-Induced Chromosome Aberrations in Human Lymphocytes In Vitro	Radiat Res. 2008 May; 169(5):575-83	http://www.ncbi.nlm.nih.gov/pubmed/18439037	We conclude that, although the 1.95 GHz signal (UMTS modulated) does not exacerbate the yield of aberrant cells caused by ionizing radiation, the overall burden of X-ray-induced chromosomal damage per cell in first-mitosis lymphocytes may be enhanced at 2.0 W/kg SAR. Hence the SAR may either influence the repair of X-ray-induced DNA breaks or alter the cell death pathways of the damage response
Markova E	2005	Microwaves from GSM mobile telephones affect 53BP1 and gamma-H2AX foci in human lymphocytes from hypersensitive and healthy persons	Environ Health Perspect. 2005 Sep; 113(9):1172-7	http://www.ncbi.nlm.nih.gov/pubmed/16140623	We found that MWs from GSM mobile telephones affect chromatin conformation and 53BP1/gamma-H2AX foci similar to heat shock. For the first time, we report here that effects of MWs from mobile telephones on human lymphocytes are dependent on carrier frequency
Martinez-Burdalo M	2004	Comparison of FDTD-calculated specific absorption rate in adults and children when using a mobile phone at 900 and 1800 MHz	Phys. Med. Biol. 49(2):345-354	http://www.ncbi.nlm.nih.gov/pubmed/15083675	Results show that peak SAR1 g and peak SAR10 g all trend downwards with decreasing head size but as head size decreases, the percentage of energy absorbed in the brain increases.
Maskey D	2010	Chronic 835-MHz radiofrequency exposure to mice hippocampus alters the distribution of calbindin and GFAP immunoreactivity	Brain Res. 2010 Jul 30;1346:237-46	http://www.ncbi.nlm.nih.gov/pubmed/20546709	Chronic RF exposure to the rat brain suggested that the decrease of CB IR accompanying apoptosis and increase of GFAP IR might be morphological parameters in the hippocampus damages
Maskey D	2010	Effect of 835 MHz radiofrequency radiation exposure on calcium binding proteins in the hippocampus of the mouse brain	Brain Res. 2010 Feb 8; 1313:232-41. Epub 2009 Dec 5	http://www.ncbi.nlm.nih.gov/pubmed/19968972	Exposure for 1 month produced almost complete loss of pyramidal cells in the CA1 area. CaBP differences could cause changes in cellular Ca(2+) levels, which could have deleterious effect on normal hippocampal functions concerned with neuronal connectivity and integration
Mathur R	2008	Effect of chronic intermittent exposure to AM radiofrequency field on responses to various types of noxious stimuli in growing rats	Electromagn Biol Med. 2008; 27(3):266-76	http://www.ncbi.nlm.nih.gov/pubmed/18821202	There are several reports of altered pain sensation after exposure (from a few minutes to hours in single or repeated doses for 2-3 weeks) to electromagnetic fields (EMF) in adults. The commonly utilized noxious stimulus is radiant heat. ... The data suggest that amplitude modulated RF field differentially affects the mechanisms involved in the processing of various noxious stimuli.
Mazor R	2008	Increased levels of numerical chromosome aberrations after in vitro exposure of human peripheral blood lymphocytes to radiofrequency electromagnetic fields for 72 hours	Radiat Res. 2008 Jan; 169(1):28-37	http://www.ncbi.nlm.nih.gov/pubmed/18159938	These results contribute to the assessment of potential health risks after continuous chronic exposure to RF radiation at SARs close to the current levels set by ICNIRP guidelines

McElroy MJ	2007	Occupational exposure to electromagnetic field and breast cancer risk in a large, population-based, case-control study in the United States.	J Occup Environ Med. 2007 Mar;49(3):266-74	http://www.ncbi.nlm.nih.gov/pubmed/17351512	Our findings, taken together with previous epidemiological studies, suggest that exposure to EMF in the workplace may be associated with a slight elevation in breast cancer risk.
Meo SA	2010	Effects of mobile phone radiation on serum testosterone in Wistar albino rats	Saudi Med J. 2010 Aug;30(8):869-73	http://www.ncbi.nlm.nih.gov/pubmed/20714683	Long-term exposure to mobile phone radiation leads to reduction in serum testosterone levels. Testosterone is a primary male gender hormone and any change in the normal levels may be devastating for reproductive and general health.
Meo SA	2005	Mobile phone related-hazards and subjective hearing and vision symptoms in the Saudi population	Int J Occup Med Environ Health. 2005; 18(1):53-7	http://www.ncbi.nlm.nih.gov/pubmed/16052891	The present study showed an association between the use of mobile phones and hearing and vision complaints. About 34.59% of problems were related with impaired hearing, ear ache and/or warmth on the ear, and 5.04% of complaints with the decreased and/or blurred vision
Meral I	2007	Effects of 900-MHz electromagnetic field emitted from cellular phone on brain oxidative stress and some vitamin levels of guinea pigs	Brain Res. 2007 Sep 12;1169:120-4	http://www.ncbi.nlm.nih.gov/pubmed/17674954	It was concluded that electromagnetic field emitted from cellular phone might produce oxidative stress in brain tissue of guinea pigs
Milham S	1988	Increased mortality in amateur radio operators due to lymphatic and hematopoietic malignancies.	Am. J. Epidemiol. 127(1), 50-54	http://www.ncbi.nlm.nih.gov/pubmed/8914716	Cumulative magnetic field exposure may be of etiologic importance in explaining the cancer incidence pattern in this cohort
Morgan LL	2009	Estimating the risk of brain tumors from cellphone use: Published case-control studies	Pathophysiology. 2009 Aug; 16(2-3):137-47	http://www.ncbi.nlm.nih.gov/pubmed/19356911	The Interphone studies have all 11 flaws, and the Swedish studies have 3 flaws (8, 9 and 10). The data from the Swedish studies are consistent with what would be expected if cellphone use were a risk for brain tumors, while the Interphone studies data are incredulous. If a risk does exist, the public health cost will be large. These are the circumstances where application of the Precautionary Principle is indicated, especially if low-cost options could reduce the absorbed cellphone radiation by several orders of magnitude.
Mousavy SJ	2009	Effects of mobile phone radiofrequency on the structure and function of the normal human hemoglobin	Int J Biol Macromol. 2009 Apr 1; 44(3):278-85	http://www.ncbi.nlm.nih.gov/pubmed/19263507	The results indicated that mobile phone EMFs altered oxygen affinity and tertiary structure of HbA. Furthermore, the decrease of oxygen affinity of HbA corresponded to the EMFs intensity and time of exposure.
Muskat J E	2000	Handheld cellular telephone use and risk of brain cancer	JAMA. 2000 Dec 20;284(23):300 1-7	http://www.ncbi.nlm.nih.gov/pubmed/11122586	Our data suggest that use of handheld cellular telephones is not associated with risk of brain cancer, but further studies are needed to account for longer induction periods, especially for slow-growing tumors with neuronal features
Myung SK	2009	Mobile phone use and risk of tumors: a meta-analysis	J Clin Oncol. 2009 Nov 20; 27(33):5565-72	http://www.ncbi.nlm.nih.gov/pubmed/19826127	The current study found that there is possible evidence linking mobile phone use to an increased risk of tumors from a meta-analysis of low-biased case-control studies. Prospective cohort studies providing a higher level of evidence are needed.
Narayanan SN	2010	Effect of radio-frequency electromagnetic radiations (RF-EMR) on passive avoidance behaviour and hippocampal morphology in Wistar rats	Ups J Med Sci. 2010 May; 115(2):91-6	http://www.ncbi.nlm.nih.gov/pubmed/20095879	Mobile phone RF-EMR exposure significantly altered the passive avoidance behaviour and hippocampal morphology in rats.
Nittby H	2009	Increased blood-brain barrier permeability in mammalian brain 7 days after exposure to the radiation from a GSM-900 mobile phone	Pathophysiology. 2009 Aug;16(2-3):103-12	http://www.ncbi.nlm.nih.gov/pubmed/19345073	The present findings are in agreement with our earlier studies where we have seen increased BBB permeability immediately and 14 days after exposure
Nittby H	2008b	Radiofrequency and extremely low-frequency electromagnetic field effects on the blood-brain barrier	Electromagn Biol Med. 2008; 27(2):103-26	http://www.ncbi.nlm.nih.gov/pubmed/18568929	The mammalian brain is protected by the blood-brain barrier, which prevents harmful substances from reaching the brain tissue. There is evidence that exposure to electromagnetic fields at non thermal levels disrupts this barrier.
Nittby H	2008a	Cognitive impairment in rats after long-term exposure to GSM-900 mobile phone radiation	Bioelectromagnetics. 2008 Apr;29(3): 219-32	http://www.ncbi.nlm.nih.gov/pubmed/18044737	Our results suggest significantly reduced memory functions in rats after GSM microwave exposure (P = 0.02).
Ntzouni MP	2011	Short-term memory in mice is affected by mobile phone radiation	Pathophysiology. 2011 Jun;18(3):193-9	http://www.ncbi.nlm.nih.gov/pubmed/21112192	The ORT [Objective Recognition Task]-derived discrimination indices in all three exposure protocols revealed a major effect on the "chronic exposure-I" suggesting a possible severe interaction of EMF with the consolidation phase of recognition memory processes
Nylund R	2006	Mobile phone radiation causes changes in gene and protein expression in human endothelial cell lines and the response seems to be genome- and proteome-dependent	Proteomics 2006 Sep; 6(17):4769-80	http://www.ncbi.nlm.nih.gov/pubmed/16878295	This suggests that the cell response to mobile phone radiation might be genome- and proteome-dependent. Therefore, it is likely that different types of cells and from different species might respond differently to mobile phone radiation or might have different sensitivity to this weak stimulus. Our findings might also explain, at least in part, the origin of discrepancies in replication studies between different laboratories

Odaci E	2008	Effects of prenatal exposure to a 900 MHz electromagnetic field on the dentate gyrus of rats: a stereological and histopathological study	Brain Research 1238, 224-229	http://www.ncbi.nlm.nih.gov/pubmed/18761003	This suggests that prenatal exposure to a 900 MHz EMF affects the development of the dentate gyrus granule cells in the rat hippocampus. Cell loss might be caused by an inhibition of granule cell neurogenesis in the dentate gyrus.
Oktay MF	2006	Effects of intensive and moderate cellular phone use on hearing function	Electromagn Biol Med. 2006; 25(1):13-21	http://www.ncbi.nlm.nih.gov/pubmed/16595330	This study shows that a higher degree of hearing loss is associated with long-term exposure to electromagnetic (EM) field generated by cellular phones
Otitoloju AA	2010	Preliminary study on the induction of sperm head abnormalities in mice, Mus musculus, exposed to radiofrequency radiations from global system for mobile communication base stations	Bull Environ Contam Toxicol. 2010 Jan; 84(1):51-4	http://www.ncbi.nlm.nih.gov/pubmed/19816647	Statistical analysis of sperm head abnormality score showed that there was a significant ($p < 0.05$) difference in occurrence of sperm head abnormalities in test animals. The major abnormalities observed were knobbed hook, pin-head and banana-shaped sperm head. The occurrence of the sperm head abnormalities was also found to be dose dependent
Palumbo R	2008	Exposure to 900 MHz Radiofrequency Radiation Induces Caspase 3 Activation in Proliferating Human Lymphocytes	Radiat Res. 2008 Sep; 170(3):327-34	http://www.ncbi.nlm.nih.gov/pubmed/18763855	After 1 h exposure to the radiofrequency field, a slight but statistically significant increase in caspase 3 activity, measured 6 h after exposure, was observed in Jurkat cells (32.4%) and in proliferating human PBLs (22%).
Panagopoulos D	2010b	The identification of an intensity 'window' on the bioeffects of mobile telephony radiation	Int J Radiat Biol. 2010 May; 86(5):358-66	http://www.ncbi.nlm.nih.gov/pubmed/20397840	The bioactivity window seems to be due to the intensity of radiation-field (10 microW/cm ²), 0.6-0.7 V/m) at 30 or 20 cm from the GSM 900 or 1800 mobile phone antenna, respectively
Panagopoulos D	2010a	Bioeffects of mobile telephony radiation in relation to its intensity or distance from the antenna	Int J Radiat Biol. 2010 May; 86(5):345-57	http://www.ncbi.nlm.nih.gov/pubmed/20397839	These radiations/fields decreased the reproductive capacity by cell death induction, at all the different distances tested. The effect diminished with the distance/decreasing intensities
Panagopoulos D	2007	Cell death induced by GSM 900-MHz and DCS 1800-MHz mobile telephony radiation	Mutat Res. 2007 Jan 10; 626(1-2):69-78	http://www.ncbi.nlm.nih.gov/pubmed/17045516	Our present results suggest that the decrease in oviposition previously reported, is due to degeneration of large numbers of egg chambers after DNA fragmentation of their constituent cells, induced by both types of mobile telephony radiation
Panda NK	2010	Audiologic disturbances in long-term mobile phone users	J Otolaryngol Head Neck Surg. 2010 Feb 1; 39(1):5-11	http://www.ncbi.nlm.nih.gov/pubmed/20122338	Long-term and intensive mobile phone use may cause inner ear damage. A large sample size would be required to reach definitive conclusions
Papageorgiou C	2006	Acute mobile phone effects on pre-attentive operation	Neurosci Lett. 2006 Apr 10-17; 397(1-2):99-103	http://www.ncbi.nlm.nih.gov/pubmed/16406308	These findings provide evidence that the MP-EMF emitted by mobile phone affect pre-attentive information processing as it is reflected in P50 evoked potential. The basis of such an effect is unclear, although several possibilities exist and call for potential directions of future research.
Pavicic I	2008	In vitro testing of cellular response to ultra high frequency electromagnetic field radiation	Toxicol In Vitro. 2008 Aug; 22(5):1344-8	http://www.ncbi.nlm.nih.gov/pubmed/18513921	Significantly decreased growth was noted in cells exposed for 3h three days after irradiation ($p < 0.05$). It seems that the 935 MHz, low-level UHF radiation affects microtubule proteins, which consequently may obstruct cell growth.
Perentos N	2008	The effect of GSM-like ELF radiation on the alpha band of the human resting EEG	Conf Proc IEEE Eng Med Biol Soc. 2008; 2008:5680-3	http://www.ncbi.nlm.nih.gov/pubmed/19164006	This result suggests that ELF fields as emitted from GSM handsets during the DTX mode may have an effect on the resting alpha band of the human EEG
Persson BRR	1997	Blood-brain barrier permeability in rats exposed to electromagnetic fields used in wireless communication	Wireless Networks 3, 455-461	http://www.springerlink.com/content/115m20650587mm73/	We have in total investigated 630 exposed rats at various modulation frequencies and 372 controls. The frequency of pathological rats is significantly increased
Peyman A	2001	Changes in the dielectric properties of rat tissue as a function of age at microwave frequencies	Phys. Med. Biol. 46(6):1617-1629	http://www.ncbi.nlm.nih.gov/pubmed/11419623	The results provide some insight into possible differences in the assessment of exposure for children and adults.
Phillips JL	2009	Electromagnetic fields and DNA damage	Pathophysiology. 2009 Aug; 16(2-3):79-88	http://www.ncbi.nlm.nih.gov/pubmed/19264461	This review describes the comet assay and its utility to qualitatively and quantitatively assess DNA damage, reviews studies that have investigated DNA strand breaks and other changes in DNA structure, and then discusses important lessons learned from our work in this area
Pourlis AF	2009	Reproductive and developmental effects of EMF in vertebrate animal models	Pathophysiology. 2009 Aug; 16(2-3):179-89	http://www.ncbi.nlm.nih.gov/pubmed/19272761	According to the majority of the investigations, no strong effects resulted regarding the exposure to EMF of mobile telephony in the animal reproduction and development. However further research should be done in order to clarify many unknown aspects of the impact of EMF in the living organisms
Preston DL	2007	Solid cancer incidence in atomic bomb survivors: 1958-1998	Radiat Res. 2007 Jul; 168(1):1-64	http://www.ncbi.nlm.nih.gov/pubmed/17722996	[latency]

Pyrpasopoulou A	2004	Bone morphogenic protein expression in newborn kidneys after prenatal exposure to radiofrequency radiation	Bioelectromagnetics 25, 216-227	http://www.ncbi.nlm.nih.gov/pubmed/15042631	Our findings suggest that GSM-like RFR interferes with gene expression during early gestation and results in aberrations of BMP expression in the newborn.
Ragbetli MC	2010	The effect of mobile phone on the number of Purkinje cells: a stereological study	Int J Radiat Biol. 2010 Jul; 86(7):548-54	http://www.ncbi.nlm.nih.gov/pubmed/20545571	A significant decrease in the number of Purkinje cells and a tendency for granule cells to increase in cerebellum was found
Rao VS	2008	Nonthermal effects of radiofrequency-field exposure on calcium dynamics in stem cell-derived neuronal cells: elucidation of calcium pathways	Radiat Res. 2008 Mar; 169(3):319-29	http://www.ncbi.nlm.nih.gov/pubmed/18302487	[Intracellular Ca(2+) spikes trigger cell proliferation, differentiation and cytoskeletal reorganization. ... While about 60% of control cells (not exposed to RF radiation) were observed to exhibit about five spontaneous Ca(2+) spikes per cell in 60 min, exposure of cells to an 800 MHz, 0.5 W/kg RF radiation, for example, significantly increased the number of Ca(2+) spikes to 15.7+/-0.8 (P<0.05).
Remondini D	2006	Gene expression changes in human cells after exposure to mobile phone microwaves	Proteomics 2006 Sep; 6(17):4745-54	http://www.ncbi.nlm.nih.gov/pubmed/16878293	Analysis of the affected gene families does not point towards a stress response. However, following microwave exposure, some but not all human cells might react with an increase in expression of genes encoding ribosomal proteins and therefore up-regulating the cellular metabolism
Repacholi MH	2011	Systematic Review of Wireless Phone Use and Brain Cancer and Other Head Tumors	Bioelectromagnetics. 2011 Oct 21 DOI 10.1002/bem.20716	http://www.ncbi.nlm.nih.gov/pubmed/22021071	Assessment of the review results using the Hill criteria did not support a causal relationship between wireless phone use and the incidence of adult cancers in the areas of the head that most absorb RF energy from the use of wireless phones. There are insufficient data to make any determinations about longer-term use (>=10 years).
Repacholi MH	1997	Lymphomas in E mu-Pim1 transgenic mice exposed to pulsed 900 MHz electromagnetic fields	Radiat Res 1997; 147: 631-40.	http://www.ncbi.nlm.nih.gov/pubmed/9146709	Thus long-term intermittent exposure to RF fields can enhance the probability that mice carrying a lymphomagenic oncogene will develop lymphomas.
Rezk AY	2008	Fetal and neonatal responses following maternal exposure to mobile phones	Saudi Med J. 2008 Feb; 29(2):218-23	http://www.ncbi.nlm.nih.gov/pubmed/18246230	Exposure of pregnant women to mobile phone significantly increase fetal and neonatal HR, and significantly decreased the COP
Richter E	2000	Cancer in radar technicians exposed to radiofrequency/microwave radiation: sentinel episodes	Int J Occup Environ Health. 6(3):187-93	http://www.ncbi.nlm.nih.gov/pubmed/10926722	The findings suggest that young persons exposed to high levels of RF/MW radiation for long periods in settings where preventive measures were lax were at increased risk for cancer.
Roux D	2008	High frequency (900 MHz) low amplitude (5 V/m) EMF: a genuine environmental stimulus that affects transcription, translation, calcium and energy charge in tomato.	Planta. 2008 Mar;227(4): 883-91	http://www.ncbi.nlm.nih.gov/pubmed/18026987	These responses occur very soon after exposure, strongly suggesting that they are the direct consequence of application of radio-frequency fields and their similarities to wound responses strongly suggests that this radiation is perceived by plants as an injurious stimulus
RNCNIRP	2011	Electromagnetic fields from mobile phones: health effect on children and teenagers. Resolution of Russian National committee of Nonionising radiation protection	Resolution of Russian National committee of Nonionising radiation protection	http://iemfa.org/images/pdf/RNCNIRP_Resolution_2011.pdf	Taking into account the RNCNIRP position and the precautionary measures suggested by WHO, the Committee considers that urgent measures must be taken because of the inability of children to recognize the harm from the mobile phone use and that a mobile phone itself can be considered as an uncontrolled source of harmful exposure.
Ruediger HW	2009	Genotoxic effects of radiofrequency electromagnetic fields	Pathophysiology. 2009 Aug; 16(2-3):89-102	http://www.ncbi.nlm.nih.gov/pubmed/19285841	Taking altogether there is ample evidence that RF-EMF can alter the genetic material of exposed cells in vivo and in vitro and in more than one way. This genotoxic action may be mediated by microthermal effects in cellular structures, formation of free radicals, or an interaction with DNA-repair mechanisms
Sadetzki S	2008	Cellular Phone Use and Risk of Benign and Malignant Parotid Gland Tumors A Nationwide Case-Control Study	Am J Epidemiol. 2008 Feb 15; 167(4):457-67	http://www.ncbi.nlm.nih.gov/pubmed/18063591	Based on the largest number of benign PGT patients reported to date, our results suggest an association between cellular phone use and PGTs
Sadetzki S	2005	Long-Term Follow-up for Brain Tumor Development after Childhood Exposure to Ionizing Radiation for Tinea Capitis	Radiation Research 163, 424-432 (2005)	http://www.ncbi.nlm.nih.gov/pubmed/15799699	While the majority of benign meningiomas (74.6%) were diagnosed 30 years or more after the exposure and only 8.9% were diagnosed in the first 20 years, only 54.8% of the malignant brain tumors were diagnosed with long latency of 30+ years and about a quarter were diagnosed within the first 20 years of follow-up.
Salama N	2010	Effects of exposure to a mobile phone on sexual behavior in adult male rabbit: an observational study	Int J Impot Res. 2010 Mar; 22(2):127-33	http://www.ncbi.nlm.nih.gov/pubmed/19940851	Therefore, the pulsed radiofrequency emitted by a conventional MP, which was kept on a standby position, could affect the sexual behavior in the rabbit

Salama N	2009	The mobile phone decreases fructose but not citrate in rabbit semen: a longitudinal study	Syst Biol Reprod Med. 2009 Dec; 55(5-6):181-7	http://www.ncbi.nlm.nih.gov/pubmed/19938952	In conclusion, the pulsed radio frequency emitted by the mobile phone kept in the standby position longitudinally affected sperm motility and fructose but not citrate levels in rabbit semen
Salford L	2008	The mammalian brain in the electromagnetic fields designed by man - with special reference to blood-brain barrier function, neuronal damage and possible physical mechanisms	Prog. Theor. Phys. Supplement No. 173 (2008) pp. 283-309	http://ptp.ipap.jp/link?PTPS/173/283	Our generation invented the microwave emitters. We now have an imperative obligation to further investigate the links between EMF and biology in order to prevent possible detrimental effects of the microwaves.
Salford L	2003	Nerve cell damage in mammalian brain after exposure to microwaves from GSM mobile phones	Environ Health Perspect 2003 Jun;111(7):881-3	http://www.ncbi.nlm.nih.gov/pubmed/12782486	We found highly significant ($p < 0.002$) evidence for neuronal damage in the cortex, hippocampus, and basal ganglia in the brains of exposed rats
Salford L	1993	Permeability of the blood-brain barrier induced by 915 MHz electromagnetic radiation, continuous wave and modulated at 8, 16, 50 and 200 Hz	Bioelectrochemistry and Bioenergetics, 30 (1993) 293-301	http://www.ncbi.nlm.nih.gov/pubmed/8012056	This reveals that both continuous and pulsed 915 MHz microwaves are able to open up the BBB for albumin passage . However, there is no significant difference between continuous and pulsed 915 MHz microwaves in this respect . The question of whether the opening of the BBB constitutes a health hazard requires further investigation .
Sannino A	2009	Induction of Adaptive Response in Human Blood Lymphocytes Exposed to Radiofrequency Radiation	Radiat Res. 2009 Jun;171(6): 735-42	http://www.ncbi.nlm.nih.gov/pubmed/19580480	These preliminary results suggested that the adaptive response can be induced in cells exposed to non-ionizing radiation.
Saracci R	2010	Commentary: Call me on my mobile phone...or better not?--a look at the INTERPHONE study results	Int J Epidemiol. 2010 Jun;39(3):695-8. Epub 2010 May 17	http://www.ncbi.nlm.nih.gov/pubmed/20483832	The tired refrain 'more research is needed' fully applies in this instance: without more research the public's question about the acceptability of cancer risk from mobile phones will remain unanswered.
Sarimov R	2004	Nonthermal GSM Microwaves Affect Chromatin Conformation in Human Lymphocytes Similar to Heat Shock	IEEE Trans Plasma Sci 2004; 32 (4): 1600 - 1608	http://ieeexplore.ieee.org/xpl/freeabs_all.jsp?arnumber=1341526	The conclusion-GSM microwaves under specific conditions of exposure affected human lymphocytes similar to stress response. The data suggested that the MW effects differ at various GSM frequencies and vary between donors
Sato Y	2011	A case-case study of mobile phone use and acoustic neuroma risk in Japan. Bioelectromagnetics.	2011 Feb;32(2):85-93.	http://www.ncbi.nlm.nih.gov/pubmed/21225885	The increased risk identified for mobile phone users with average call duration >20 min/day should be interpreted with caution, taking into account the possibilities of detection and recall biases. However, we could not conclude that the increased risk was entirely explicable by these biases, leaving open the possibility that mobile phone use increased the risk of acoustic neuroma.
Schirmacher A	2000	Electromagnetic fields (1.8 GHz) increase the permeability to sucrose of the blood-brain barrier in vitro	Bioelectromagnetics, 21(5), 338-45	http://www.ncbi.nlm.nih.gov/pubmed/10899769	Exposure to EMF increased permeability for (14)C-sucrose significantly compared to unexposed samples. The underlying pathophysiological mechanism remains to be investigated
Schoemaker MJ	2005	Mobile phone use and risk of acoustic neuroma: results of the Interphone case-control study in five North European countries.	Br J Cancer. 2005 Oct 3;93(7):842-8	http://www.ncbi.nlm.nih.gov/pubmed/16136046	The study suggests that there is no substantial risk of acoustic neuroma in the first decade after starting mobile phone use. However, an increase in risk after longer term use or after a longer lag period could not be ruled out.
Schuz J	2011	Long-Term Mobile Phone Use and the Risk of Vestibular Schwannoma: A Danish Nationwide Cohort Study	Am J Epidemiol. 2011 Jun 28	http://www.ncbi.nlm.nih.gov/pubmed/21712479	Overall, no evidence was found that mobile phone use is related to the risk of vestibular schwannoma. Because of the usually slow growth of vestibular schwannoma and possible diagnostic delay, further surveillance is indicated
Schuz J	2006	Cellular telephone use and cancer risk: update of a nationwide Danish cohort	J Natl Cancer Inst. 2006 Dec 6;98(23):1707-13	http://www.ncbi.nlm.nih.gov/pubmed/17148772	We found no evidence for an association between tumor risk and cellular telephone use among either short-term or long-term users.
Schwarz C	2008	Radiofrequency electromagnetic fields (UMTS, 1,950 MHz) induce genotoxic effects in vitro in human fibroblasts but not in lymphocytes	Int Arch Occup Environ Health. 2008 May; 81(6):755-67	http://www.ncbi.nlm.nih.gov/pubmed/18278508	UMTS exposure may cause genetic alterations in some but not in all human cells in vitro

Seyhan N	2011	Investigation on blood-brain barrier permeability and collagen synthesis under radiofrequency radiation exposure and SAR simulations of adult and child head	Eur. J. Oncol. - Library Vol. 5	http://www.medicalinformation.it/ecommerce/non-thermal-effects-and-mechanisms-of-interaction-between-electromagnetic-fields-and-living-matter-an-icems-monograph.html	Increase in BBB permeability was found to be statistically significant in all male rats exposed, whereas no significant difference was observed in female rats.
Sharma VP	2009	Mobile phone radiation inhibits Vigna radiata (mung bean) root growth by inducing oxidative stress	Sci Total Environ. 2009 Oct 15; 407(21):5543-7. Epub 2009 Aug 13	http://www.ncbi.nlm.nih.gov/pubmed/19682728	The study concluded that cell phone EMF inhibit root growth of mung bean by inducing ROS-generated oxidative stress despite increased activities of antioxidant enzymes
Sirav B	2009	Blood-brain barrier disruption by continuous-wave radio frequency radiation	Electromagn Biol Med. 2009;28(2):215-22	http://www.ncbi.nlm.nih.gov/pubmed/19811403	Results have shown that 20 min RFR exposure of 900 and 1,800 MHz induces an effect and increases the permeability of BBB of male rats. There was no change in female rats. The scientific evidence on RFR safety or harm remains inconclusive.
Soderqvist F	2010	Radiofrequency fields, transthyretin, and Alzheimer's disease	J Alzheimers Dis. 2010; 20(2):599-606	http://www.ncbi.nlm.nih.gov/pubmed/20164553	We propose that TTR might be involved in the findings of RF exposure benefit in AD mice.
Soderqvist F	2009	Exposure to an 890-MHz mobile phone-like signal and serum levels of S100B and transthyretin in volunteers	Toxicol Lett. 2009 Aug 25; 189(1):63-6. Epub 2009 May 7	http://www.ncbi.nlm.nih.gov/pubmed/19427372	The clinical significance of this finding, if any, is unknown. Further randomized studies with use of additional more brain specific markers are needed
Soderqvist F	2009	Mobile and cordless telephones, serum transthyretin and the blood-cerebrospinal fluid barrier: a cross-sectional study	Environ Health. 2009 Apr 21; 8:19	http://www.ncbi.nlm.nih.gov/pubmed/19383125	In this hypothesis-generating descriptive study time since first use of mobile telephones and DECT combined was significantly associated with higher TTR levels regardless of how much each telephone type had been used. Regarding short-term use, significantly higher TTR concentrations were seen in women the sooner blood was withdrawn after the most recent telephone call on that day.
Sommer AM	2009	Effects of radiofrequency electromagnetic fields (UMTS) on reproduction and development of mice: a multi-generation study	Radiat Res. 2009 Jan;171(1):89-95	www.ncbi.nlm.nih.gov/pubmed/19138054	In summary, the results of this study do not indicate harmful effects of long-term exposure of mice to UMTS over several generations
Sonmez OF	2010	Purkinje cell number decreases in the adult female rat cerebellum following exposure to 900 MHz electromagnetic field	Brain Res. 2010 Oct 14;1356:95-101	http://www.ncbi.nlm.nih.gov/pubmed/20691167	Results showed that the total number of Purkinje cells in the cerebellum of the EMFG was significantly lower than those of CG (p<0.004) and SG (p<0.002). In addition, there was no significant difference at the 0.05 level between the rats' body and brain weights in the EMFG and CG or SG. Therefore, it is suggested that long duration exposure to 900 MHz EMF leads to decreases of Purkinje cell numbers in the female rat cerebellum
Stang A	2001	The possible role of radiofrequency radiation in the development of uveal melanoma	Epidemiology. 2001 Jan; 12(1):7-12	http://www.ncbi.nlm.nih.gov/pubmed/11138823	This is the first study describing an association between radiofrequency radiation exposure and uveal melanoma. Several methodologic limitations prevent our results from providing clear evidence on the hypothesized association.
Swerdlow AJ	2011	Mobile Phones, Brain Tumours and the Interphone Study: Where Are We Now?	Environ Health Perspect. doi:10.1289/ehp.1103693	http://ehp03.niehs.nih.gov/article/fetchArticle.action?articleURI=info%3Adoi%2F10.1289%2Fehp.1103693	Although there remains some uncertainty, the trend in the accumulating evidence is increasingly against the hypothesis that mobile phone use can cause brain tumours in adults
Szmigielski S	1996	Cancer morbidity in subjects occupationally exposed to high frequency (radiofrequency and microwave) electromagnetic radiation	Sci Total Environ. 1996 Feb 2;180(1):9-17	http://www.ncbi.nlm.nih.gov/pubmed/8717316?dopt=Abstract	Among malignancies of the haemopoietic/lymphatic systems, the largest differences in morbidity rates between exposed and non-exposed personnel were found for chronic myelocytic leukaemia (OER = 13.9), acute myeloblastic leukaemia (OER = 8.62) and non-Hodgkin lymphomas (OER = 5.82).
Szmigielski S	1982	Accelerated development of spontaneous and benzopyrene-induced skin cancer in mice exposed to 2450-MHz microwave radiation	Bioelectromagnetics 1982; 3: 179-91.	http://onlinelibrary.wiley.com/doi/10.1002/bem.2250030202/abstract	Microwave-exposed C3H/HeA mice developed breast tumors earlier than controls.
Takebayashi T	2008	Mobile phone use, exposure to radiofrequency electromagnetic field, and brain tumour: a case-control study	Br J Cancer. 2008 Feb 12;98(3):652-9. Epub 2008 Feb 5	http://www.ncbi.nlm.nih.gov/pubmed/18256587	A non-significant increase in OR among glioma patients in the heavily exposed group may reflect recall bias

Takebayashi T	2006	Mobile phone use and acoustic neuroma risk in Japan	Occup Environ Med. 2006 Dec;63(12):802-7. Epub 2006 Aug 15	http://www.ncbi.nlm.nih.gov/pubmed/16912083	These results suggest that there is no significant increase in the risk of acoustic neuroma in association with mobile phone use in Japan
Thomas S	2010	Exposure to radio-frequency electromagnetic fields and behavioural problems in Bavarian children and adolescents	Eur J Epidemiol. 2010 Feb;25(2):135-41	http://www.ncbi.nlm.nih.gov/pubmed/19960235	We aimed to investigate a possible association between measured exposure to RF EMF fields and behavioural problems in children and adolescents. The results showed an association between exposure and conduct problems for adolescents (3.7; 1.6-8.4) and children (2.9; 1.4-5.9).
Tomruk A	2010	The influence of 1800 MHz GSM-like signals on hepatic oxidative DNA and lipid damage in nonpregnant, pregnant, and newly born rabbits	Cell Biochem Biophys. 2010;56(1):39-47	http://www.ncbi.nlm.nih.gov/pubmed/19851891	Consequently, the whole-body 1800 MHz GSM-like RF radiation exposure may lead to oxidative destruction as being indicators of subsequent reactions that occur to form oxygen toxicity in tissues
Verschaeve L	2009	Genetic damage in subjects exposed to radiofrequency radiation	Mutat Res. 2009 Mar-Jun;681(2-3):259-70	http://www.ncbi.nlm.nih.gov/pubmed/19073278	A majority of these studies do show that RF-exposed individuals have increased frequencies of genetic damage (e.g., chromosomal aberrations) in their lymphocytes or exfoliated buccal cells. However, most of the studies, if not all, have a number of shortcomings that actually prevents any firm conclusion
Volkow ND	2011	Effects of Cell Phone Radiofrequency Signal Exposure on Brain Glucose Metabolism	JAMA. 2011 Feb 23;305(8):808-13	http://www.ncbi.nlm.nih.gov/pubmed/21343580	In healthy participants and compared with no exposure, 50-minute cell phone exposure was associated with increased brain glucose metabolism in the region closest to the antenna. This finding is of unknown clinical significance
Vorobyov V	2010	Repeated exposure to low-level extremely low frequency-modulated microwaves affects cortex-hypothalamus interplay in freely moving rats: EEG study	Int J Radiat Biol. 2010 May; 86(5):376-83	http://www.ncbi.nlm.nih.gov/pubmed/20397842	These results are in line with evidence that repeated low-level exposure to ELF-MW affects brain functioning
Wang B	2000	Acute exposure to pulsed 2450-MHz microwaves affects water-maze performance of rats	Bioelectromagnetics. 2000 Jan; 21(1):52-6	http://www.ncbi.nlm.nih.gov/pubmed/10615092	These results show that acute exposure to pulsed microwaves caused a deficit in spatial "reference" memory in the rat.
Wang J	2003	Comparison and evaluation of electromagnetic absorption characteristics in realistic human head models of adult and children for 900-MHz mobile telephones	IEEE Trans.Microwav e Theor. Techniq. 51(3):966-971	http://ieeexplore.ieee.org/xpl/freeabs_all.jsp?arnumber=1191755	Compared to the local peak SAR in the adult head model, we found a considerable increase in the children's heads when we fixed the output power of the monopole-type antenna, but no significant differences when we fixed the effective current of the dipole-type antenna.
Wang Q	2005b	Effect of 900 MHz electromagnetic fields on the expression of GABA receptor of cerebral cortical neurons in postnatal rats	Wei Sheng Yan Jiu. 2005 Sep; 34(5):546-8	http://www.ncbi.nlm.nih.gov/pubmed/16329593	The expression of GABA receptor of neurons were significantly regulated by 900 MHz microwave, and a power "window" effect was observed in the exposed neurons
Wang Q	2005a	Effect of 900MHz electromagnetic fields on energy metabolism in postnatal rat cerebral cortical neurons	Wei Sheng Yan Jiu. 2005 Mar; 34(2):155-8	http://www.ncbi.nlm.nih.gov/pubmed/15952649	The microwaves play a role of accumulation in the effect on exposed neurons, the trends in dose response relationship were found between the exposure intensity and the effects, effect of the microwave on exposed neurons should be classified as athermal effects of EMF
Wang Q	2004	Effect of 900MHz electromagnetic fields on energy metabolism of cerebral cortical neurons in postnatal rat	Wei Sheng Yan Jiu. 2004 Jul; 33(4):428-9, 432	http://www.ncbi.nlm.nih.gov/pubmed/15461266	Down-regulation of CCO should be classified as 'non-thermal effects'. Cumulated power effect were observed in neuronal response to the microwave.
Wdowiak A	2007	Evaluation of the effect of using mobile phones on male fertility	Ann Agric Environ Med. 2007;14(1):169-72	http://www.ncbi.nlm.nih.gov/pubmed/17655195	In the analysis of the effect of GSM equipment on the semen it was noted that an increase in the percentage of sperm cells of abnormal morphology is associated with the duration of exposure to the waves emitted by the GSM phone. It was also confirmed that a decrease in the percentage of sperm cells in vital progressing motility in the semen is correlated with the frequency of using mobile phones
Wiert J	2008	Analysis of RF exposure in the head tissues of children and adults	Phys. Med. Biol. 53(13):3681-3695	http://www.ncbi.nlm.nih.gov/pubmed/18562780	They indicate that the maximum SAR in 1 g of peripheral brain tissues of the child models aged between 5 and 8 years is about two times higher than in adult models
Wiholm C	2009	Mobile phone exposure and spatial memory	Bioelectromagnetics. 2009 Jan; 30(1):59-65	http://www.ncbi.nlm.nih.gov/pubmed/18792947	The symptomatic group improved their performance during RF exposure while there was no such effect in the non-symptomatic group. Until this new finding is further investigated, we can only speculate about the cause.

Wilen J	2003	Subjective symptoms among mobile phone users--a consequence of absorption of radiofrequency fields?	Bioelectromagnetics. 2003 Apr; 24(3):152-9	http://www.ncbi.nlm.nih.gov/pubmed/12669297	The results indicates that SAR values >0.5 W/kg may be an important factor for the prevalence of some of the symptoms, especially in combination with long calling times per day
Wood	2006	Does evening exposure to mobile phone radiation affect subsequent melatonin production?	Journal of Radiation Biology 82(2), 69-76	http://www.ncbi.nlm.nih.gov/pubmed/16546905	Total nighttime melatonin output is unchanged by mobile phone handset emissions, but there could be an effect on melatonin onset time
Xu S	2010	Exposure to 1800 MHz radiofrequency radiation induces oxidative damage to mitochondrial DNA in primary cultured neurons	Brain Res. 2010 Jan 22;1311:189-96	http://www.ncbi.nlm.nih.gov/pubmed/19879861	Together, these results suggested that 1800 MHz RF radiation could cause oxidative damage to mtDNA in primary cultured neurons. Oxidative damage to mtDNA may account for the neurotoxicity of RF radiation in the brain
Yakymenko I	2010	Risks of carcinogenesis from electromagnetic radiation of mobile telephony devices	Exp Oncol. 2010 Jul; 32(2):54-60	http://www.ncbi.nlm.nih.gov/pubmed/20693976	Practical steps must be done for reasonable limitation of excessive EMR exposure, along with the implementation of new safety limits of mobile telephony devices radiation, and new technological decisions, which would take out the source of radiation from human brain
Yakymenko, I	2011	Long-term exposure to microwave radiation provokes cancer growth: evidences from radars and mobile communication systems.	Experimental Oncology, 33(2), 62-70.	http://www.ncbi.nlm.nih.gov/pubmed/21716201	In this review we discuss alarming epidemiological and experimental data on possible carcinogenic effects of long term exposure to low intensity microwave (MW) radiation. Recently, a number of reports revealed that under certain conditions the irradiation by low intensity MW can substantially induce cancer progression in humans and in animal models.
Yan JG	2008	Upregulation of specific mRNA levels in rat brain after cell phone exposure	Electromagn Biol Med. 2008; 27(2):147-54	http://www.ncbi.nlm.nih.gov/pubmed/18568932	These results indicate that relative chronic exposure to cell phone microwave radiation may result in cumulative injuries that could eventually lead to clinically significant neurological damage
Yan JG	2007	Effects of cellular phone emissions on sperm motility in rats	Fertil Steril. 2007 Oct; 88(4):957-64	http://www.ncbi.nlm.nih.gov/pubmed/17628553	These results suggest that carrying cell phones near reproductive organs could negatively affect male fertility
Yao K	2008	Electromagnetic noise inhibits radiofrequency radiation-induced DNA damage and reactive oxygen species increase in human lens epithelial cells	Mol Vis. 2008 May 19; 14:964-9	http://www.ncbi.nlm.nih.gov/pubmed/18509546	DNA damage induced by 1.8 GHz radiofrequency field for 2 h, which was mainly SSBs, may be associated with the increased ROS production. Electromagnetic noise could block RF-induced ROS formation and DNA damage
Ye LL	2007	Radar radiation damages sperm quality	Zhonghua Nan Ke Xue. 2007 Sep;13(9):801-3	http://www.ncbi.nlm.nih.gov/pubmed/17929556	Radar radiation damages sperm quality, as shown in the reduction of sperm motility and elevation of sperm abnormality. Cease from the exposure may effect an easy recovery in sperm morphology
Zareen N	2009	Derangement of chick embryo retinal differentiation caused by radiofrequency electromagnetic fields	Congenit Anom (Kyoto). 2009 Mar; 49(1):15-9	http://www.ncbi.nlm.nih.gov/pubmed/19243412	We conclude that EMF emitted by a mobile phone cause derangement of chicken embryo retinal differentiation
Zhang SZ	2008	Effect of 1.8 GHz radiofrequency electromagnetic fields on gene expression of rat neurons	Zhonghua Lao Dong Wei Sheng Zhi Ye Bing Za Zhi. 2008 Aug;26(8):449-52	http://www.ncbi.nlm.nih.gov/pubmed/19358751	The effect of RF intermittent exposure on gene expression was more obvious than that of continuous exposure

2. OVERVIEW STUDIES & REPORTS

The following publications have also been taken into account in compiling this report. They are not single, peer-reviewed scientific papers as in the case of all the above references, but overview reports by scientists, public bodies or other organisations.

Organisation/Author(s)	Date	Title	Reference
Bioinitiative Report	2007	BioInitiative Report: A Rationale for a Biologically-based Public Exposure Standard for Electromagnetic Fields (ELF and RF)	http://www.bioinitiative.org/freeaccess/report/
Council of Europe Parliamentary Assembly	2011	Resolution 1815 (2011): The potential dangers of electromagnetic fields and their effect on the environment	http://assembly.coe.int/Mainf.asp?link=/Documents/AdoptedText/ta11/ERES1815.html
European Environment Agency	2002	Late lessons from early warnings: the precautionary principle 1896-2000	http://www.eea.europa.eu/publications/environmental_issue_report_2001_22

European Environment Agency	2009	Statement on Mobile Phones for Conference on Cell Phones and Health: Science and Public Policy Questions	http://www.emrpolicy.org/files/15sep09_mcglade_statement.pdf
European Environment Agency	2011	Statement on Mobile Phones and the Potential Head cancer risk for the EMF Hearing on EMF, Council of Europe, Paris, February 25th 2011	http://www.icems.eu/docs/StatementbyJMGFeb252011.pdf?f=c/a/2009/12/15/MNHJ1B49KH.DTL
Hansard	2010	House of Commons. 20 Dec 2010 : Column 1284 Mobile Phones (Health Effects) (Adjournment Debate)	http://www.publications.parliament.uk/pa/cm201011/cmhansrd/cm101220/debtext/101220-0004.htm
Health Protection Agency	2011	Health Advice on Mobile Phones	http://www.hpa.org.uk/web/HPAweb&HPAwebStandard/HPAweb_C/1195733769169
Health Protection Agency	2011	Mobile Telephony and Health: Exposures from Mobile Phones	http://www.hpa.org.uk/Topics/Radiation/UnderstandingRadiation/UnderstandingRadiationTopics/ElectromagneticFields/MobilePhones/info_MobilePhones/
Hill, Sir Austin Bradford	1965	The Environment and Disease: Association or Causation? (republished Bull World Health Organ. 2005 October; 83(10): 796–798)	http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1898525/
IARC	2011	IARC monographs on the evaluation of carcinogenic risks to humans, vol 102. Non-ionizing radiation, part II: radiofrequency electromagnetic fields. Lyon: International Agency for Research on Cancer	http://www.iarc.fr/en/media-centre/pr/2011/pdfs/pr208_E.pdf
IEGMP (Independent Expert Group on Mobile Phones),	2000	Mobile phones and health (The Stewart Report),	www.iegmp.org.uk/IEGMPtxt.htm
International Commission on Non-Ionizing Radiation Protection (ICNIRP)	2011 (updated)	Publications: Guidance on radiofrequency	http://www.icnirp.org/PubEMF.htm
Ofcom	2011	Ofcom Communications Market Report (August 2011)	http://stakeholders.ofcom.org.uk/market-data-research/market-data/communications-market-reports/cmr11/
REFLEX Study (Risk Evaluation of Potential Environmental Hazards From Low Frequency Electromagnetic Field Exposure Using Sensitive in vitro Methods)	2000-2008	Multiple studies published	http://www.verum-foundation.de/uploads/media/QLK4-CT-1999-01574_REFLEX_Publications_01.pdf
RNCNIRP (Russian National Committee of Nonionising Radiation Protection)	2011	Electromagnetic fields from mobile phones: health effect on children and teenagers	http://iemfa.org/images/pdf/RNCNIRP_Resolution_2011.pdf
Stein and Philips (EM Radiation Trust, Powerwatch and Electromagnetic Man)	2011	The Evidence connecting Mobile Phone EMF Exposure and Male Infertility	http://www.radiationresearch.org/images/RRT_articles/Save%20the%20Male%20Fertility%20v1.pdf
UK Health Protection Agency	2011 (updated)	Health Advice on Mobile Phones	http://www.hpa.org.uk/Topics/Radiation/UnderstandingRadiation/UnderstandingRadiationTopics/ElectromagneticFields/MobilePhones/info_HealthAdvice/
UK Mobile Telecommunications and Health Research (Prof Lawrie Challis)	2007	Report 2007	http://www.mthr.org.uk/documents/MTHR_report_2007.pdf
Vodafone	2011	Parents guide: mobile phones and health	http://parents.vodafone.com/health
World Health Organization	2011	Electromagnetic fields and public health: mobile phones	http://www.who.int/mediacentre/factsheets/fs193/en/